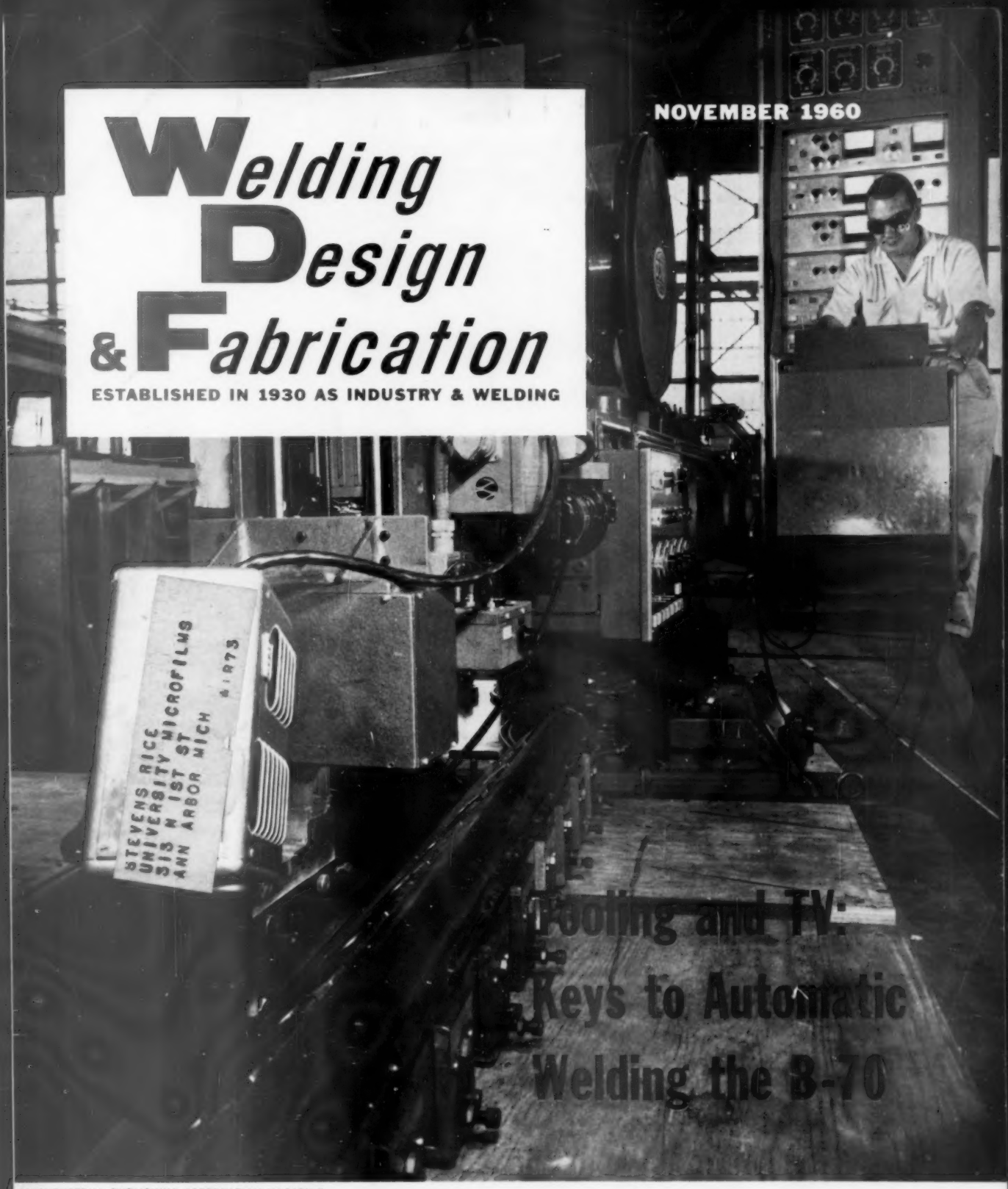

Welding Design & Fabrication

ESTABLISHED IN 1930 AS INDUSTRY & WELDING

NOVEMBER 1960

STEVENS RICE
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Tooling and TV: Keys to Automatic Welding the B-70

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

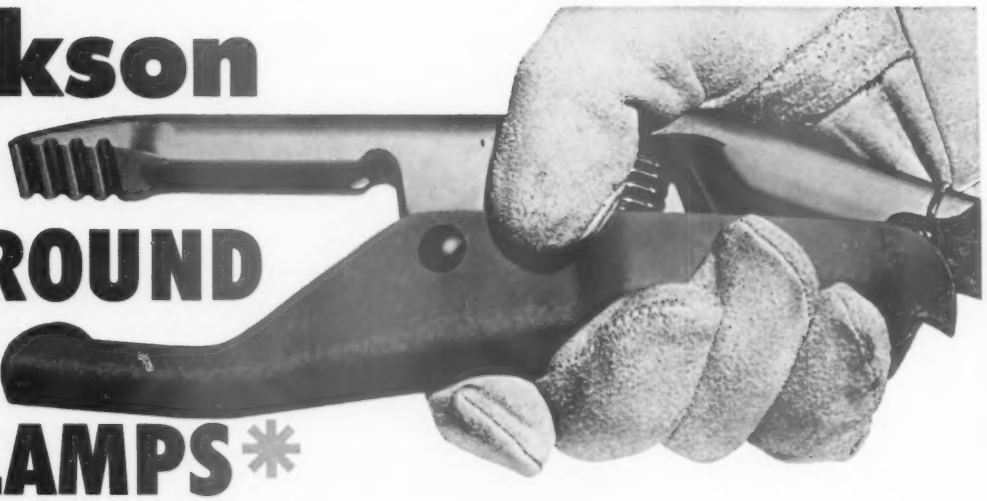
ALSO IN THIS ISSUE

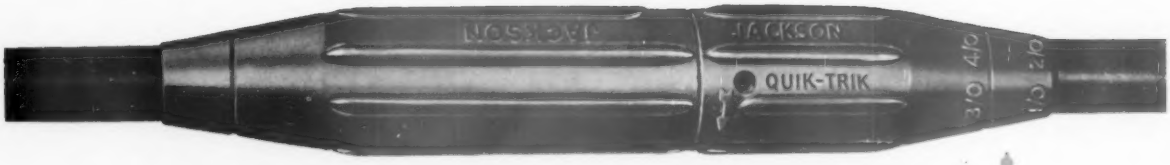
DOES A RADIOGRAPHED PRESSURE VESSEL COST MORE?

HOW TO MAKE WELDING HOSE AND CABLE LAST LONGER

CANADA WELDS LARGEST SOLID-SECTION BUILDING COLUMNS

Jackson GROUND CLAMPS*





CABLE CONNECTORS†

& CABLE LUGS

* Jackson Ground Clamps work easily and efficiently. One end fits the hand, with finger-grooved lower tong. Proper placement—current-carrying upper tong on top where you're sure of good contact—is natural and easy.

The business end fits the job. The contact area of the copper alloy upper tong is large and flat, with serrations that bite through surface film. Greater contact area carries current efficiently. New melamine-impregnated fiber glass insulators at pivot keeps current out of lower tong.

† Jackson 'Quik-Trik' Cable Connectors have streamlined Neoprene rubber insulators that lock out moisture, dirt, and don't catch on obstructions. Cable connects mechanically, or by soldering or brazing. The reduced tip diameter on the tapered plug takes hard knocks without forming a burr that will interfere with the mating of the halves.

Models to fit cable sizes 1 thru 4/0, sold everywhere by better welding supply dealers

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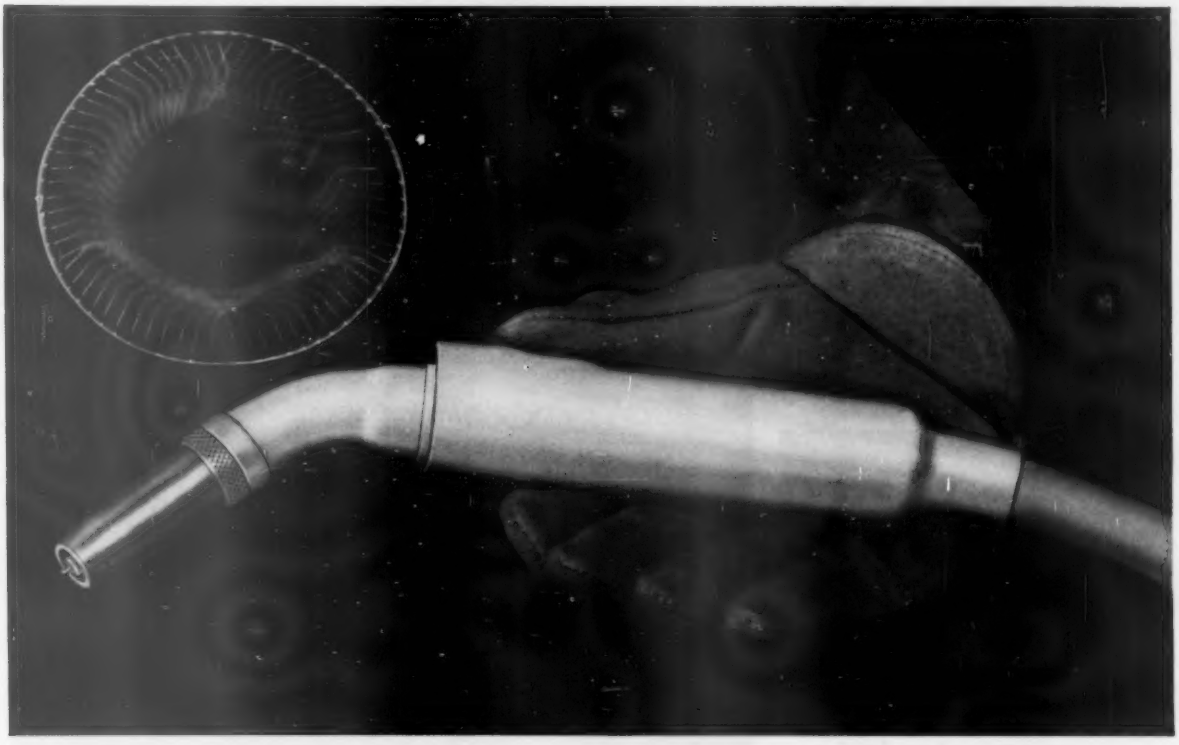
AIR REDUCTION SALES CO., A DIVISION OF AIR REDUCTION CO., INC.

31739 Mound Road, Warren, Michigan

For More Information Circle No. 42 on Reader Service Card.

FASTEST GUN* IN WELDING!



EXCLUSIVE HOBART Micro-wire PROCESS IS UP TO 50% FASTER THAN OLDER WELDING METHODS (and much more versatile)

- Welds in **all positions**.
- Welds **light and heavy gage** with minimum distortion.
- Uses **inexpensive** CO_2 gas.
- Permits welding **up to 200 amperes** DC.

* Here's why: Even less experienced operators achieve superior results in all position welding at high traveling speeds. The gun is light. It maneuvers quickly. The gentle curve of its nozzle puts the Micro-wire into position, where conventional holders and stick electrodes may not reach. Low distortion, low spatter, low welding current and little or no clean-up make the operator's job easy. He can weld thin sheets manually with semi-automatic equipment—even poorly fitted joints. All connections to the gun are encased in a single flexible, lightweight, small diameter extruded jacket. Get the complete story about Hobart's exclusive Micro-wire process. See how your production costs can be radically cut.

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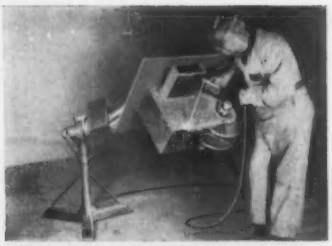
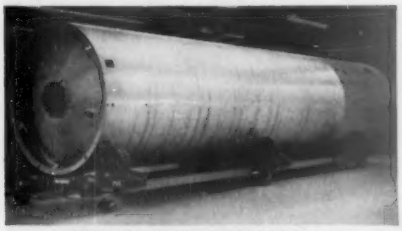


Aronson UNIVERSAL BALANCE Positioners
T.M. Reg. U. S. Patent Office
Patent No. 2,787,826



ARONSON TracTred TURNING ROLLS
T.M. Reg. U. S. Patent Office
Patent No. 2,669,364

Aronson GEARED ELEVATION Positioners
T.M. Registry applied for. - Patent Applied For.

Aronson EXCALIBUR Positioner
350,000 Lbs. Load Capacity

Aronson 600 TONNER Rolls
World's Mightiest Turning Rolls

Aronson Offers You Over 400 PROVEN *Standard Stock Models* of Quality POSITIONERS

Aronson leads all others in precision, dependability and service. *Aronson* positioners are not a sideline to a larger operation. Our business life depends entirely on customer acceptance of the *Aronson* line of welding positioners and turning rolls.

We ship on or before promised date for 90% of orders we get and are never more than 10% late regardless of the cause.

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For instant service on new machines or replacement parts telephone Arcade, New York, Number 276 or 277 or 278.

ARONSON supplies the "other half" you need to make perfect welds at minimum cost. Positioning the work is the "other half" . . . as important as the arc and the shielding element. ARONSON POSITIONERS are as modern and efficient as the latest welding processes.

Quality POSITIONERS by *Aronson* MACHINE COMPANY, INC.

ARCADE, NEW YORK

WELDING POSITIONERS • TANK TURNING ROLLS • TURNTABLES

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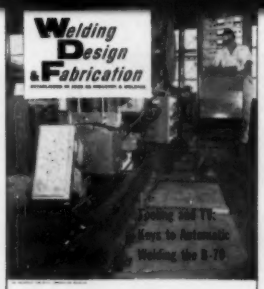
reader's guide to



for November, 1960

COVER: This manipulator machine with a 12-foot boom makes circumferential and longitudinal welds on shapes as slender as 20 inches in diameter. This machine features closed circuit television that enables the operator to watch the weld as it is made. This does away with the need for an extra man to watch welding and verbally relay information to the machine operator. The machine is also equipped with an X-ray head that makes possible continuous in-motion radiographic inspection.

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FEATURES

31 DOES A RADIOGRAPHED VESSEL COST MORE TO BUILD?

Some pressure vessel builders still think radiography takes money out of their pockets. An expert disproves this notion; he proves that radiography is an economic necessity.

34 SPOT WELDING BUILDS RELIABLE MINIATURIZED ELECTRONIC PARTS

This precision process is ideal for assembling the many minute dissimilar metal parts found in electronic components.

36 TV AND TOOLING: AUTOMATIC WELDING THE B-70 JET BOMBER

North American Aviation developed new automatic arc welding techniques and equipment to join brazed steel honeycomb panel sections.

38 LEAK-FREE WELDS ARE KEYS TO WORLD'S LARGEST STAINLESS SPHERES

A 75,000-gallon low pressure tank and an 8,000-gallon high pressure tank hold liquid oxygen for Air Force missiles.

43 SEA WILL SEE MORE WELDED ALUMINUM BOATS

There's a trend toward welded aluminum for medium tonnage boats. Here's how the largest aluminum passenger boat in the country was built.

44 HOW TO MAKE WELDING HOSE AND CABLE LAST LONGER

Pinches, blows, and sharp edges are harder on welding hose and cable than wear, abrasion, or heat. Here's how to avoid this damage.

46 CANADA WELDS LARGEST SOLID-SECTION BUILDING COLUMNS

Welded columns in a 430-foot building replace built-up riveted shapes that were usually used on multi-story building that high.

48 WHY HAVE FABRICATED TURBINES REPLACED ONE-PIECE CASTINGS?

Allis-Chalmers makes strong, defect-free, and cheaper fabricated runners by welding together smaller castings and steel places.

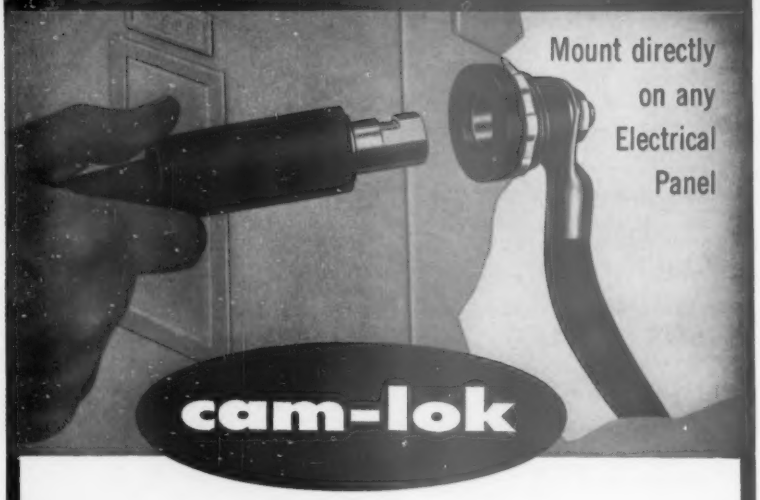
52 WHY MARTIN BRAZES IN A VACUUM FURNACE

This aircraft company also uses its unique cold-wall high-temperature vacuum furnace to heat treat, anneal, and sinter.

DEPARTMENTS

6 WELDING AT WORK
9 MEN ON THE MOVE
12 LETTERS TO THE EDITOR
17 WELDING LIBRARY
20 NEWS OF THE INDUSTRY
26 WELDING MANAGEMENT
58 USEFUL FREE LITERATURE
63 NEW WELDING PRODUCTS
73 LITERATURE IN ADS
73 OPPORTUNITIES
74 ADVERTISERS' INDEX

New Hi-Impact Plastic Insulated Panel Receptacles and Mating Plugs



Now, you can make fast, positive power connections to any metal panel or housing without special insulating materials. Simply punch out a hole and insert a Cam-Lok self-insulated Receptacle! Uses standard electrical lock-nuts, affords "dead-front" protection. Push in and twist Cam-Lok mating Plug and you've made a locked connection, which can be released quickly.

New Cam-Lok Receptacles eliminate costs of special insulating panels and reduce assembly time. Patented, high-pressure contact assures minimum resistance and heating.

Cam-Lok has a complete line of Receptacles and Plugs in many sizes and designs. Standard and special purpose Power Distribution Connections are available. Write today for new Bulletin No. 301.

"Dead Front" design for fast direct mounting on . . .

- **ELECTRICAL DISTRIBUTION PANELS**
- **SWITCHGEAR**
- **BUS DUCT**
- **JUNCTION BOXES**
- **WIREWAY or any electrical cubicle**

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CINCINNATI 36, OHIO

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Welding Design & Fabrication

FRANCHISE CIRCULATION

BPA

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with NEW Harris multi-stage precision metering regulators

1 Four times as accurate (within 3%) as most flowmeter type metering regulators.

2 Easily read gauge dial designed to show actual flow in cubic feet per hour consumed.

3 May be attached to the cylinder in any position and accuracy of flow is not affected.

4 Constant flow, as originally set, is maintained as the content of the cylinder decreases.

5 No gaskets to loosen, causing loss of gas and erroneous reading of flows.

Delivery range from vacuum pressures to 2500 lbs.

Applicable to most gases.

Give us information on your particular requirements.

Model No.	Type	Delivery in cu. ft. per hr. (S. C. F. H.)	Inlet Connection CGA No.
92 AR	Argon	0-40	580
92 ARA	Argon	0-40	540
92 ARX	Argon	0-100	580
92 HE	Helium	0-125	590
92 O_2	Oxygen	0-100	540
92 CO_2	Carbon Dioxide	0-100	320
92 N_2	Nitrogen	0-100	580
92 H_2	Hydrogen	0-100	350

Note: If inlet connection other than standard required, specify CGA No.
Other regulators are available for other gases.

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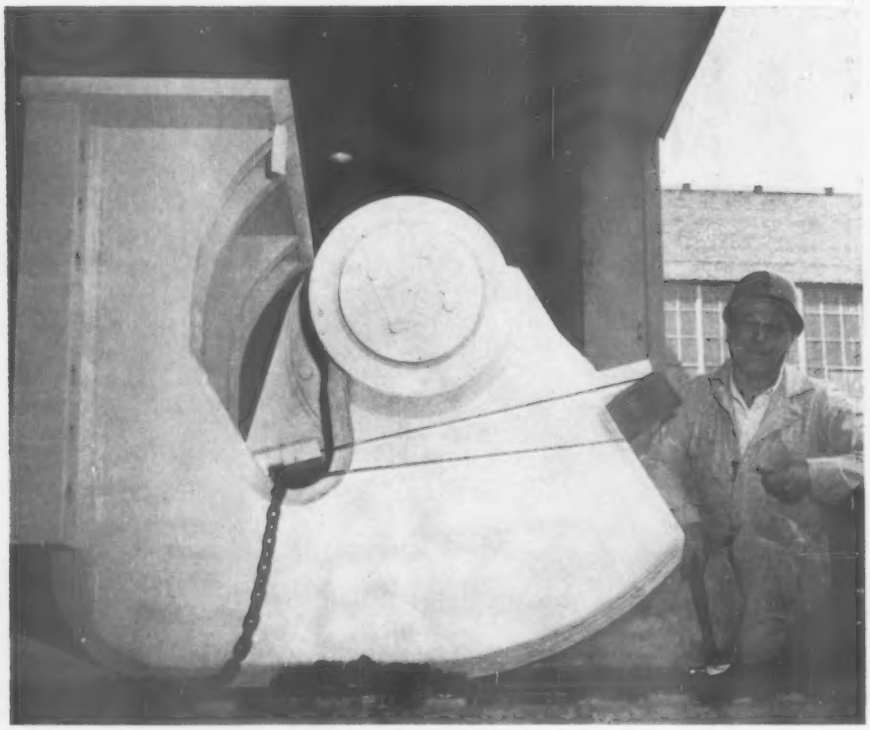
WELDING AT WORK

to do the job better and cheaper



600-ton hinges are flame cut and welded

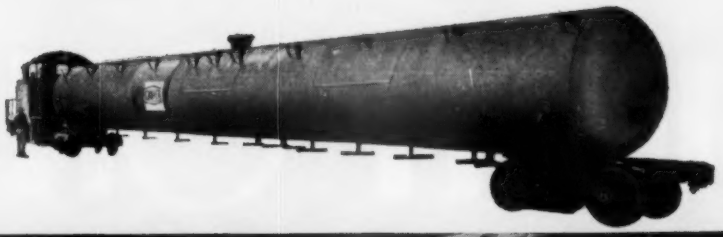
COATESVILLE, PA: This hinge will open the doors of the underground silos that house the Air Force's Titan ICBM. Nearly five feet high, this is one on a set of 600-ton hinges, that the Lukens Steel Co. flame cut, machined and welded. The man kneeling beside the hinge gives an idea of its massiveness. Yet, the heavy gage steel was fabricated to tolerances as delicate as those on the hinges of a jewel case.

Radiographic testing laboratory flies anywhere

BELLEVILLE, N. J.: A flying laboratory for non-destructive testing is available from General Magnaplate Corp. At a moment's notice, the company's crew and technicians will fly anywhere in the country.

Testing is done with a Baltospot 140 KV portable x-ray unit made by Balteau Electric Corp., Stamford, Conn. The lightweight, compact unit has an X-ray head that weighs only 48 lbs. and a control panel that weighs 26 lbs. It can be operated by one man and can be used on steel up to 1¾ inches thick.

ON THIS, the World's largest tank car,



WELD QUALITY PROVEN . . . X-RAYED BY

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FEDREX
RADIOGRAPHY EQUIPMENT

There can be no guess-work about the welds in this huge carrier of L-P gas under pressure.

That's why Graver Tank & Mfg. Co., a division of Union Tank Car Company, utilizes the safe, fast and easy-to-use Curtiss-Wright portable FEDREX X-ray Unit — to assure weld quality throughout the 85-foot length of this tank for the world's largest railroad tank cars being built by Union Tank Car Company.

Recently fabricated by Graver, it is one of the first of such tanks, each 8′3″ in diameter by 85′ long with a capacity of 30,000 gallons of liquified petroleum gas under pressure.

FEDREX units are the most compact and versatile in their KV range, and have proved most effective on materials from thin plastic to four-inch steel plate. They are available in 140, 160, 200 and 260 KV models adaptable to 110, 220, or 440-volt power input. The unit used on the L-P tank car welds has a KV range from 85 to 260 . . . a milliampere range of 2.2 to 5. Superior shielding keeps stray radiation down to 5 mr/hr or less at ten feet. High maximum current ratings result in shorter exposure time . . . more exposures per day and less production interruption.

Send for the FEDREX Bulletin or phone SWinburne 9-0500.

According to Mr. Clarence Unger, Chief Inspector at Graver, the FEDREX unit is rugged, dependable and easy to use. Shown in operation is the Curtiss-Wright 260 KV FEDREX X-ray unit on stand under control of operator. X-ray film is inside the tank.

Princeton Division **CURTISS WRIGHT** Princeton, New Jersey
CORPORATION

In CANADA: Canadian Curtiss-Wright Ltd. • 43 Westminster Avenue, North • Montreal 28, P, Q., Canada

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The swiftest, simplest, surest way to fasten metal . . .

NEW BUTTON WELD

BY

A.O. SMITH

C-OMANUAL button welding boosts output . . . cuts rejects

Here's one button the zipper hasn't replaced. In fact, this button process is the latest development in welding — a development that has replaced old-fashioned spot-resistance welding and riveting.

Armed with a lightweight hand gun using A. O. Smith's CO_2 C-OMANUAL process, the operator works from one side only. The button burns through to fasten steel up to 3/16 in the downhand position and 3/64 in the vertical. And welders take their helmets off to button welding — no need to wear one with this A. O. Smith process. Simple, too! Special operator training is not required. Just place the gun . . . pull the trigger! Hold until the welding stops *automatically*. Perfect button weld every time . . . no flux to clean.

Choice of nozzles permits welding of any of the standard joints (lap, fillet, butt).

Timed fillet button weld | Typical Burn-thru button weld | Burn-thru button weld — light-gage

Other button blessings include quality low-hydrogen weld metal, high deposition rates, full utilization of weld metal for low overall costs. Put this high-speed production tool to work for you. Send for Bulletin MW-253 for details.

Through research ... *a better way*

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WELDING PRODUCTS DIVISION
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MEN ON THE MOVE

in the welding industry

PROMOTIONS:

PHILLIPS, above

HENDRICH, above, right

TOWNSEND, right

Tweco Products, Inc., Wichita, Kansas, announces several promotions. They are: **J. T. Phillips,** general sales manager; **L. J. Hendrich,** general production manager; **J. L. Townsend,** advertising and sales promotion manager. **Wm. R. Roberts** is new manager of the company's branch plant in Harper, Kansas.

John K. Bybee will represent Ampco Metal, Inc., Milwaukee, in the Southeastern United States.

Eutectic Welding Alloys Corporation, Flushing, N. Y., has named **Melvin S. Holder** regional manager in Indiana and Southern Illinois.

Jack H. Rees is in charge of a new sales office opened in Washington, D.C., by the Welding Products Division of A. O. Smith Corp. According to Division General Sales Manager **R. W. Raney,** the new office will better serve the expanding welding equipment needs of the military services and other government agencies. Mr. Rees will also cover Maryland, Virginia, and North Carolina.

APPOINTMENTS:

STAAL THOMPSON

Ralph Staal takes over the newly created position of industrial sales manager of Marquette Manufacturing Co., Minneapolis, Minn., manufacturer of arc and oxy-acetylene welding equipment and supplies.

Ray W. Thompson has been appointed general sales manager of Square D Company's Marketing Division. Mr. Thompson will operate from Park Ridge, Illinois.

Frank W. Green has joined the engineering section of General Electric's Resistance Welding Control Department in Detroit.

The Wallco and Stainless Processing Division of Wall Colmonoy Corporation have appointed **William McGahey** representative for processing and fabrication services in Indiana.

Doan Ryle has been appointed manager of the new X-Ray Equipment Division of Labquip, Inc., Chicago, Ill. The company represents Balteau Electric Corp., Stamford, Conn.

Charles R. Fessinger has been appointed sales engineer by Scott-Tarbell, Inc., Cleveland, Ohio.

Max Kadonoff will represent Stoody Company, Whittier, Calif., in Ontario, Quebec, and the Maritime provinces of Canada. He will work with Stoody's distributor, Air Reduction Canada Limited.

Robert T. Cavanagh has been appointed general manager of Philips Electronic Instruments, Division of Philips Electronics & Pharmaceutical Industries Corp., Mt. Vernon, N. Y.

continued on page 10

ARE YOU GETTING the MOST for YOUR MONEY?

Consider these LOW PRICED *Seamless and Fabricated*

VULCANIZED FIBRE WELDING HELMETS

460-4-C – Straight front for extra chest and throat protection; with Inner Bib for added light and fume seal; seamless; lift-front glassholder.

666-P9 – Fabricated with flat sides, narrow, compact (preferred by Western weldors); light and comfortable; leakproofed seams; 668-P9 has lift-front glassholder.

270-4-C – Seamless; curved bottom to exclude fumes and light; comfortable free-floating headgear with Ratchet adjustment; fixed-front glassholder.

Inner Bib – Straight front shells give increased neck and chest protection. Available with this Inner Bib for added light and fume seal!

Noted for comfort and safety, these FIBRE-METAL Helmets are formed and fabricated from finest quality, full gauge vulcanized fibre. They "seal" the weldor against light leakage and afford fullest ventilation.

All helmets have Ratchet Adjustment *"free floating"* Headgear, impact resistant adjustable friction joints and adjustable chin rest. Glassholders are available in plastic, steel or Dowmetal, in either fixed-front or lift-front styles.

All types and models of FIBRE-METAL Welding Helmets are described in Catalog No. 26. **Ask your Welding & Safety Distributor!**

The FIBRE-METAL Products Company | CHESTER PENNA

In CANADA: Fibre-Metal (Canada) Limited, Toronto

For More Information Circle No. 31 on Reader Service Card.

MEN ON THE MOVE

continued from page 9

ELECTIONS:

FISHER

CHATTERTON

Simon "Si" Fisher was elected president of National Electric Welding Machines Co., Bay City, Mich. He succeeds **Edward C. Smith,** who will become chairman of the board.

Bruce Chatterton has been elected president of S-M-S Corporation, Detroit, succeeding **James C. Cox** who has retired. Mr. Chatterton joined S-M-S as vice president in 1959.

HONORS:

Albert Rovey (second from left) receives a Hobart 180 amp arc welder as first prize in a Farm Welding Contest sponsored by Phoenix Welding Supply Co., Phoenix, Arizona. Phoenix Welding's **Bob Robbins** (second from right) presents the award. Second place winner, **John Aleman, Jr.** (extreme right) received a Smith Welding Equipment Corp. oxy-acetylene welding and cutting outfit. Third prize of $100 worth of Stoody hardsurfacing alloys went to **Marvin Sheppard** (left).

DEATHS:

Sam Shaykin, president and founder of Chicago Welding Sales Co. and its subsidiary, York Engineering Co., passed away on September 6, 1960, at 72. He had been in the welding business since 1910.

HOW DO YOU WELD STAINLESS?

With stick electrodes?..by gas shielded metal arc welding (Aircomatic®)?..by gas shielded tungsten arc welding (Heliweld)?

Airco supplies electrodes or wire for *all three*, can give unbiased advice, broad selection. Are the stainless steels that you weld light gauge or heavy . . . martensitic, ferritic or austenitic . . . subject to heat, corrosion or stress? Whatever the application, Airco supplies electrodes or wire to weld them *better*.

For stick electrode welding: choose from 36 Airco Stainless Electrode types. They give you high welding speed with low heat input. Welds are smooth, spatter is minimal, cleaning and polishing are easy. Bonus: electrodes are protected in Airco's exclusive resealable "POP" can; it keeps them factory-fresh down to the last electrode.

For inert gas shielded processes: depending on application, you'll choose either AIRCOMATIC® gas shielded metal arc welding—or Airco's HELIWELD gas shielded tungsten arc welding. For both of these processes, Airco Stainless steel welding or filler wire gives excellent corrosion resistance and excellent tensile, ductility and impact properties.

Which is best for you? Call Airco for an unbiased answer—for *only* Airco makes equipment for all three processes. Look in Classified Telephone Directory under "Welding Equipment and Supplies" for your nearest Authorized Airco Distributor. Write today for a copy of Airco's "Electrode Pocket Guide" and "Aircomatic Welding Wire Pocket Guide."

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LETTERS

to the editor

WELDED BRIDGES

Editor:

I have reviewed with much interest the August issue of WELDING DESIGN & FABRICATION, and especially the article having to do with welded highway bridges.

I hope you will accept our congratulations. This is one of the fields in which we are greatly interested and hope to do some constructive work in the near future.

Fred L. Plummer,
national secretary,
American Welding Society

WELDING DESIGN PROBLEM

Editor:

We are now producing a part from a steel casting which I believe can be made better and more economically by welding. The general shape consists of a tubular hub with rectangular flat vanes extending radially from the hub attached to the hub along an axial plane. The hub outside diameter between vanes, which are located 180° apart, must have a surface finish of 16 R.M.S. We now have to finish this contour on a Fellows-type gear-cutting machine which is time consuming and costly.

I would like to know if we could start with tubing having its outside diameter ground to 16 R.M.S. and weld the vanes in place without too much distortion. Concentricity of the finished hub must be held to .002 inch maximum.

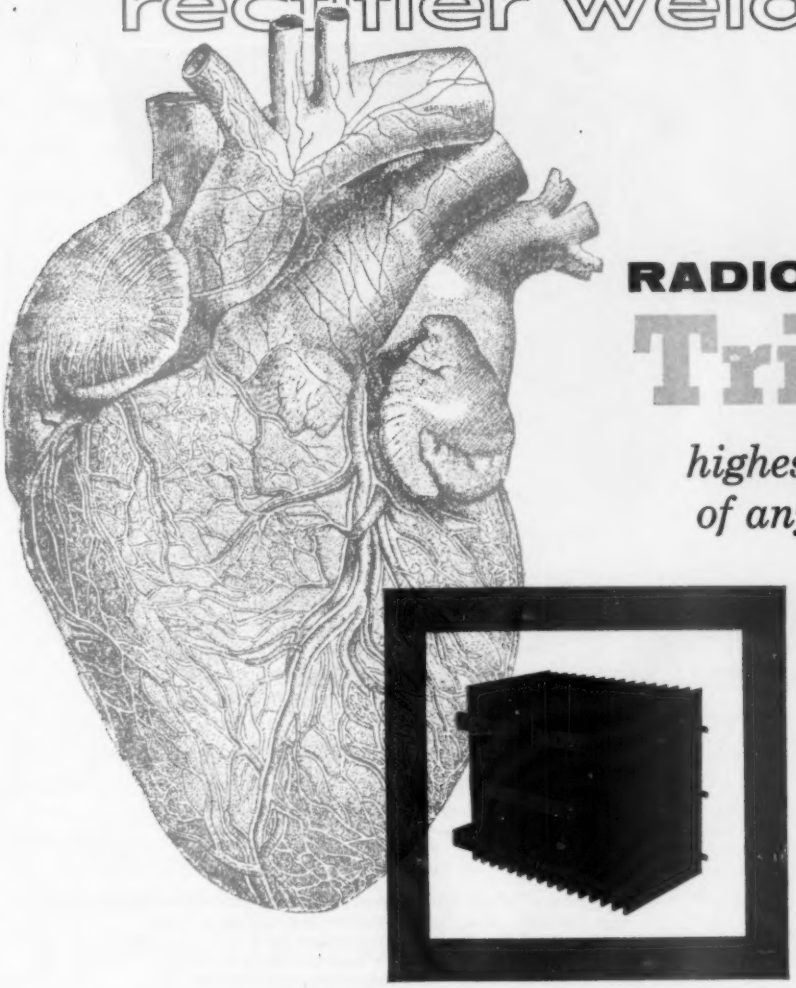
We plan to go into production of these units immediately and want to cut all possible unnecessary costs first.

Can you refer this article to someone who has had some experience in fabricating articles of this type?

Samuel I. Caldwell,
project engineer,
Philadelphia Gear Corporation

• *We referred Mr. Caldwell's request for information to several sources. If any of our readers have advice for Mr. Caldwell, we will be glad to forward it to him.*

at the heart of rectifier welders...



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highest surge capacity of any semiconductor

WELDING makes the toughest demands on a rectifier of all industries. When an arc is struck the rectifier is subject to current surges up to three times its rated operating current . . . And when the arc is broken the rectifier is subject to transients two to three times the PIV.

That's why many manufacturers of rectifier welders are turning to Tri-Amp. It runs at current densities three times as high as welding industry standards without any signs of deterioration, has current capabilities greater than any other selenium rectifier.

The secret is that, like all new semiconductors, Tri-Amp has a true P-N junction. No artificial barrier layer is required, thus eliminating the primary cause of aging and giving the benefit of a lower forward voltage drop. Tri-Amp has longer life, smaller size and no special current balancing or protective devices are required.

Expensive? In most applications Tri-Amp actually represents a significant saving; *yours may be one of them!* For more information, read "The Tri-Amp as an Improved Source of Rectification in Welding Equipment Application." Simply circle Reader Service Card No. 57

Tri-Amp is currently used in 200, 300, 500 and 1,000 amp welders — and going higher!

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Magnaflux KCH-3D provides easily mobile in-plant weld tests on heavy equipment. One of the many Magnaflux models, starting with hand-portable kits at $195.

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Magnaflux-Magnaglo *magnetic particle* inspection offers you the lower cost, fully accepted test to find *all* weld cracks, as well as lack of penetration, lack of fusion, etc. (Actual cost is 6½ cents or less per foot of weld, including the cost of two inspectors and moving of scaffolding.) This test offers great savings, compared to other tests or to the disastrous cost of failure.

Magnaflux-Magnaglo weld testing is now specified by several highway departments and safety authorities for bridges and other public structures, during erection—even including shop-weldments. This is a result of its proven safety and savings on building structural members, large cranes and derricks—oil rigs and pipelines and plant equipment, and heavy fabricated machinery.

The cost to you? *Very little.* We will sell you the test units specially selected for your needs (starting as low as $195) or, for a very modest fee, take the whole testing job off your hands with our Field Testing Service, operating out of 15 principal cities.

Write or call Magnaflux Corporation, 7348 W. Lawrence Avenue, Chicago 31, Illinois.

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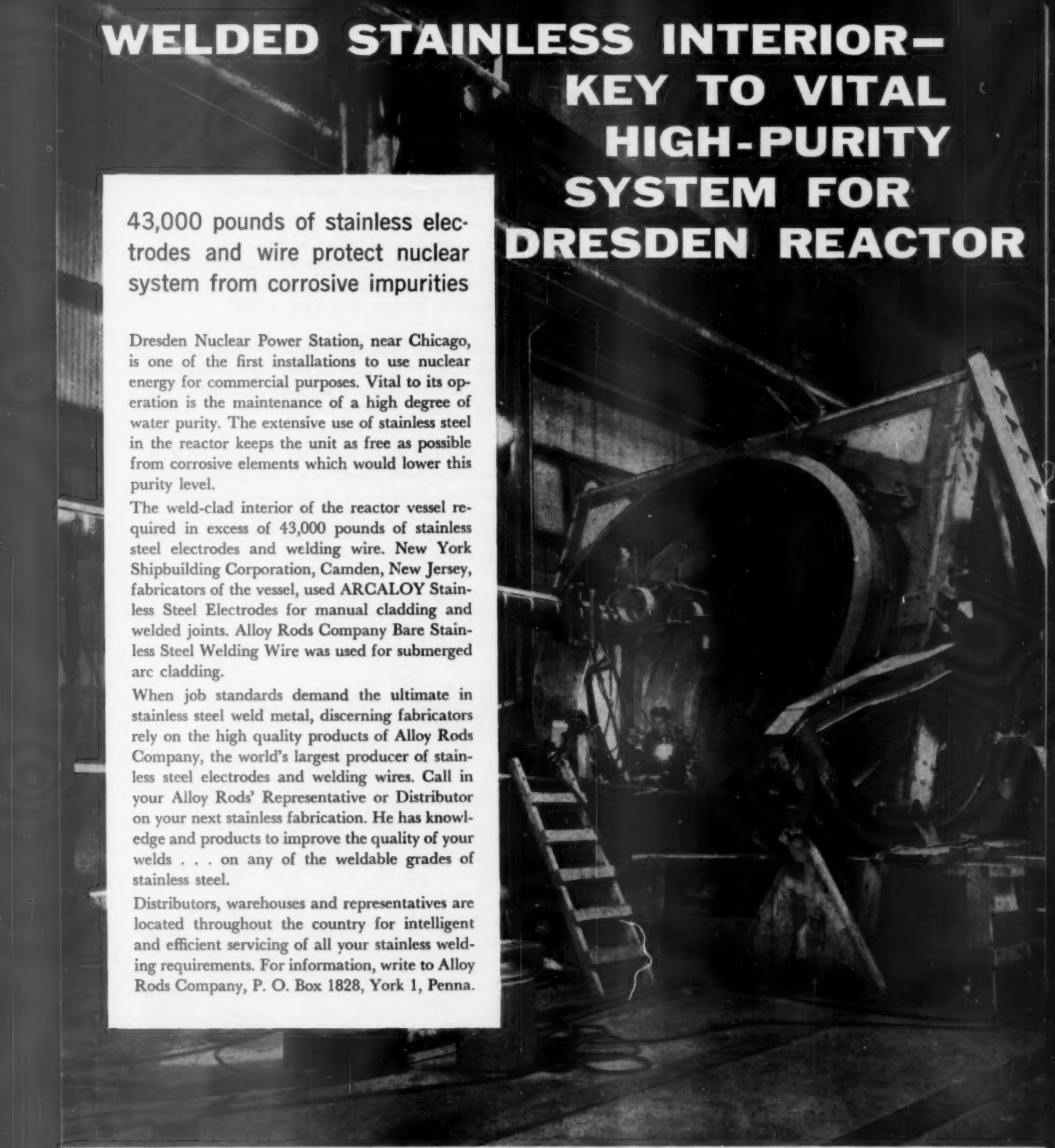
Circle No. 12 on Reader Service Card. ⟶

WELDED STAINLESS INTERIOR— KEY TO VITAL HIGH-PURITY SYSTEM FOR DRESDEN REACTOR



43,000 pounds of stainless electrodes and wire protect nuclear system from corrosive impurities

Dresden Nuclear Power Station, near Chicago, is one of the first installations to use nuclear energy for commercial purposes. Vital to its operation is the maintenance of a high degree of water purity. The extensive use of stainless steel in the reactor keeps the unit as free as possible from corrosive elements which would lower this purity level.

The weld-clad interior of the reactor vessel required in excess of 43,000 pounds of stainless steel electrodes and welding wire. New York Shipbuilding Corporation, Camden, New Jersey, fabricators of the vessel, used ARCALOY Stainless Steel Electrodes for manual cladding and welded joints. Alloy Rods Company Bare Stainless Steel Welding Wire was used for submerged arc cladding.

When job standards demand the ultimate in stainless steel weld metal, discerning fabricators rely on the high quality products of Alloy Rods Company, the world's largest producer of stainless steel electrodes and welding wires. Call in your Alloy Rods' Representative or Distributor on your next stainless fabrication. He has knowledge and products to improve the quality of your welds . . . on any of the weldable grades of stainless steel.

Distributors, warehouses and representatives are located throughout the country for intelligent and efficient servicing of all your stainless welding requirements. For information, write to Alloy Rods Company, P. O. Box 1828, York 1, Penna.

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YORK, PENNSYLVANIA

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why it'll pay you to see PICKER *first*

about radiographic inspection problems

*e.g.

1 here you get **exactly the right machine**—x-ray or isotope—to handle your problem best (x-ray is better for some jobs, isotopes for others). Nowhere else can you find anything even approaching the range of radiographic equipment Picker offers *(see index below for some idea)*

2 here you get **topflight local service** - the dependable facilities of the nationwide Picker X-Ray service network. Right in your own backyard there's probably a local Picker office with service engineers constantly on the job to keep your equipment running at peak form.

3 here you get **expert counsel** on *anything* and *everything* having to do with radiography or fluoroscopy. We'll test radiograph your own product and come up with recommendations. Advise you on exposure technics: plan and supervise shielded installations—go the whole way *with* you, *for* you. We even offer a training course on Basics of Radiography: it comes free with the purchase of Picker equipment.

4 all this at your command by simply calling your local Picker office (see 'phone book) or writing Picker X-Ray Corporation, 25 South Broadway, White Plains, New York.

*e.g *for in-the-field radiography of steel up to 2" thick (e.g., pipeline work)*

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Will radiograph full girth weld of inch-thick 8" diameter steel pipe in four minutes.
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LIBRARY

of welding

Ultrasonic Testing

"Research and Development Leading to the Establishment of Ultrasonic Test Standards for Aircraft Materials," G. L. Cross and others, Ultrasonic Testing and Research Laboratory, for Wright Air Development Division, U. S. Air Force, Feb. 1960, 147 *pages. Order PB* 161753 *from OTS, U. S. Department of Commerce, Washington* 25, *D. C.,* $2.75.

Reporting the results of a study evaluating ultrasonic techniques for detecting internal defects, this report includes information on material variables in steel, aluminum, and titanium; the analysis of variables involved in contact and immersed methods; discussion of beam diameter; and the possibilities of predicting static and fatigue properties of materials containing gross amounts of very minute discontinuities.

Vest-Pocket Manual

"Engineer's Vest-Pocket Book," Ottenheimer Publishers, Inc., 4805 *Nelson Ave., Baltimore* 15, *Md.,* 192 *pages,* 2⅝ *x* 5½, $0.90.

You'll find the properties of structural steel, the resistance of an immersed body moving through fluid, thermal stress, cost estimating, properties of minerals, chemical solubility, and 250 other items in this book.

There is an alphabetical index, an index of 47 charts and tables, plus 12 marginal-indexed headings: mathematics, building, mechanics, heat, hydraulics, pipes, electricity, surveying, costing, mining, chemistry, and miscellaneous data.

Technical Research

"Welding of High-Strength Steel for Aircraft and Missile Application," by H. W. Mishler and others, Defense Metals Information Center, Battelle Memorial Institute, Oct. 1959, 93 *pages, Order PB* 151074 *from OTS, U. S. Department of Commerce, Washington* 25, *D. C.,* $2.25.

This report is a survey of techniques currently used to make welded joints in aircraft and missiles that are sound and approach the strength of the parent metal. There are separate discussions on low-alloy martensitic steels, hot-work die steels, martensitic stainless steels, and precipitation-hardening stainless steels.

continued on page 18

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HARRISBURG CYLINDERS
Because Harrisburg Steel has never settled for anything less than the best in quality controls and production methods, the service life of their gas cylinders, which is usually over 30 years, has become the basis of standards for the industry. No other cylinder manufacturer can make this claim for only Harrisburg and Taylor-Wharton, both divisions of Harsco Corporation, have made cylinders for over 30 years.
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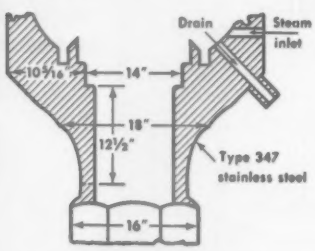
Profit through E.A.I. Research



Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.

SMITH-DOLAN On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

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ELECTRIC-ARC

For More Information Circle No. 28 on Reader Service Card.

continued from page 17

Steel Specifications

"Tentative Specifications for Structural Steel, ASTM Designation A 36-60 T," American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., $0.50 per copy (minimum order $1.00).

The new A 36-60 T structural steel now joins A7 and A 373 steels as a stock item for steel mills and warehouses. Design stresses have been established and published by the American Institute of Steel Construction.

The guaranteed minimum yield point of A 7 steel is 33,000 psi and of A 373 steel is 32,000 psi. For the new A 36 steel is it 36,000 psi.

The new A 36 steel requires a tensile strength of 60,000 to 80,000 psi. The minimum carbon content is specified as 0.28 per cent ladle, 0.32 per cent check analysis. Additional requirements for manganese contents are imposed for plates or bars over ¾ inch thick, and for plates over 1½ inch thick, a silicon content is also specified.

Three Joining Memos

"Recent Developments in Titanium Brazing", PB 161195 (DMIC Memo 45). March, 1960 8 pages. $.50.

"Brazing for High-Temperature Service", PB 161198, (DMIC Memo 48). March 1960. 15 pages. $.50.

"Notes on the Diffusion Bonding of Metals", PB 161203, (DMIC Memo 53). April, 1960. 9 pages. $.50. All from Defense Metals Information Center, Battelle Memorial Institute, Order from OTS, U. S. Dept. of Commerce, Washington, D. C.

Information is contained in the three memorandums which will be useful to those engaged in metal joining. PB161195: Developments of improved brazing filler metals are discussed and evaluated. PB 161198: The extent of advancement in the field of brazing for service temperatures in excess of 600°F is summarized. PB 161203: Diffusion bonding is discussed as a joining technique obtaining coalescence of clean closely fitting parts by applying pressure with or without heating the assembly.

The WELDING DATA BOOK

contains 931 pages of information . . .

see page 23

How Ni-Rod "55" builds up worn cast iron... keeps repair cost down

When the owners of the M V Sunprincess heard it would cost them over $7,200 to replace all six worn ship pistons, they quickly called in J & R Weir Ltd., Marine Engineers, Montreal.

These engineers in turn recommended a Ni-Rod "55"* repair job – welding to be done by Welding Engineers Ltd., Montreal.

Wear ran as high as ⅛ inch on some of the piston ring grooves. But with Ni-Rod "55" Electrodes, welders soon had all six pistons back in the ship at a total cost of $2,450 – a saving of over $4,750.

How they did the job with Ni-Rod "55"

Using Ni-Rod "55" Electrodes, they welded cast iron inserts into position on the pistons to offset the worn areas. The pistons were pre-heated to 500° F and each of the 6 inserts welded into position with two passes by manual arc-welding. After welding, the pistons were covered with asbestos to cool. Ni-Rod "55" eliminated the need for post-heating. Then the pistons were machined and returned to the engine.

For your jobs

Ni-Rod "55" can be used to build up worn areas in almost all cast iron parts. Auto, truck, or ship pistons... valve seats... cylinder walls... are just a few. And the cost is just a fraction of what replacement would cost. What's more, with Ni-Rod "55", the repair is done quickly and easily. Welds are strong, sound, highly machinable.

Keep Ni-Rod "55" in mind for building up worn areas on cast iron parts. Even better, have a supply of these electrodes on hand. Look in your classified directory under "Nickel" for your local supplier.

And *write* for "Repair Cast Iron Parts Quickly and Easily" for the complete Ni-Rod "55" story.

HUNTINGTON ALLOY PRODUCTS DIVISION
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INCO WELDING PRODUCTS
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electrodes • wires • fluxes

For More Information Circle No. 41 on Reader Service Card.

ELECTRODE specification was introduced recently at a luncheon sponsored by NEMA's Arc Welding Section. Attending were (clockwise from lower left) R. T. Brown, Metal & Thermit Corp., chairman; Rear Admiral F. B. Schultz, Bureau of Ships; James E. Norcross, Arcos Corp.; E. F. Seaman, Bureau of Ships; Capt. E. H. Schantz, Bureau of Ships; and Joseph F. Miller, NEMA's managing director.

NEMA And Navy Develop New Electrode Specification

WASHINGTON, D. C.: More than three years of study by a special committee of the Arc Welding Section of the National Electrical Manufacturers Association and a series of conferences with the welding branch of the U. S. Navy Bureau of Ships has resulted in a single specification that covers the items common to all specifications for covered welding electrodes. The Department of Defense has assigned standardization responsibility for welding electrodes to the Bureau of Ships.

The Bureau of Ships has issued the document called Miliatry Specification Electrodes, Welding, Covered; General Specification, MIL-22200 (SHIPS). Announced here at a recent luncheon of military representatives, the specification includes general requirements, quality assurance, provisions, test procedures, and instructions for preparation for delivery for covered welding electrodes.

BACKGROUND

A study by the NEMA Section's Committee on Federal and Military Specifications showed that many items in various specifications for covered welding electrodes were common to all and that authors of each were saying the same thing in different ways. Users of the specifications were losing time determining if the specifications were different, similar, or the same.

HOW IT WAS DONE

The Committee reviewed all covered electrode specifications issued by government agencies and drafted one general specification. With this as a starting point, the NEMA Committee and the welding branch of the Bureau of Ships developed a document which was mutually acceptable.

WHAT WILL HAPPEN?

There will be substantial savings in several areas. For example, engineering staffs in government agencies will be able to use the general specification in preparing new specifications. They will be able to cover any grade of electrode by issuing one- or two-page documents covering the unique properties of that electrode, and not 20 to 30 pages, the bulk of which is common to all electrodes. The new specification will also cut in half the file space formerly needed for storing individual specifications and will result in a corresponding saving in cataloging and filing time. The Committee hopes that the specification will become a government standard and that it will be widely used in private industries.

Members of the Committee are J. E. Norcross, Arcos Corporation, Chairman; C. M. Dick, Metal & Thermit Corp.; E. F. Helm, McKay Company; E. B. Lutes, Arcrods Company; and R. A. Wilson, Lincoln Electric Co.

NEMA Publishes New Welder Control Standard

NEW YORK CITY: The National Electrical Manufacturers Association has published a new revised standard for resistance welder controls.

Developed by NEMA's Industrial Control Section, the new standard—"Resistance Welding Control-IC-2-1960"—includes definitions and cycle diagrams for all generally used resistance welding processes. Definitions and diagrams are cross-referenced with a master table listing NEMA identification numbers for the control equipment required to perform each of the described functions. All major control manufacturers list this equipment by NEMA number, as well as their own model or type numbers.

Also listed are minimum standards for such factors as accuracy, time range, size, and capacity, which are widely used in industry.

Separate sections are included for frequency converter controls, gun welder controls, and multifunction process timers.

Copies are available from NEMA at 155 East 44th St., New York 17, N. Y. Price is $1.00.

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NEW ALL-IN-ONE "MIG" WELDING EQUIPMENT

Welding equipment is designed, developed and refined, but eventually it must be redesigned. LINDE'S new SIGMATIC line of "Mig" welding equipment is a product of this evolution . . . plus LINDE'S vast experience with more inert-gas and consumable-electrode processes than any other company in the world. The SIGMATIC line is the most-versatile semi-automatic equipment available anywhere—one machine for:

- **. . . all types of "Mig" welding—spray arc, short arc and spot welding**
- **. . . in all welding positions—vertical, overhead or downhand**
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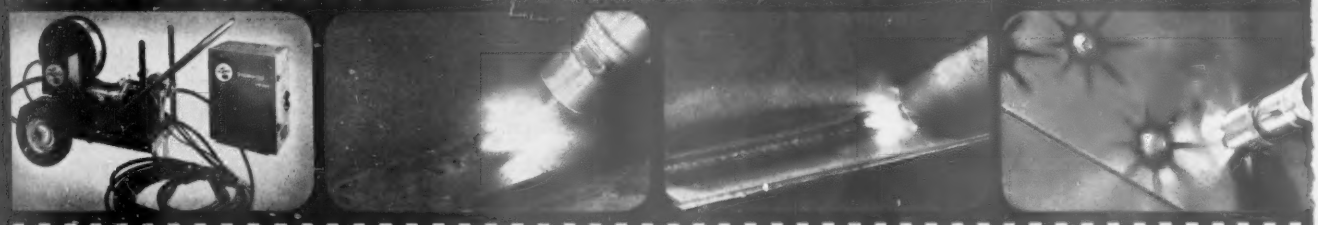
- **. . . and all wires—hard or soft, solid or tube**
- **. . . on all weldable metals—carbon steel, stainless, aluminum, magnesium, titanium**
- **. . . on all thicknesses—sheet metal and up**

See next page for details.

SIGMATIC



One SIGMATIC machine for... spray arc... short arc... spot welding

Spray arc, short arc, spot welding... never before combined in a single piece of equipment. SCC-8 control incorporates special spot-welding circuitry, featuring a directly-calibrated, precision weld timer and an independently-adjustable, "non-stick" timer. Converts from spot to continuous fusion welding at the flick of a switch. SEH-2 heavy-duty wire-feed unit—largest, most-rugged unit available today—permits positive feed of all "Mig" wire types, metals and diameters. The SIGMATIC line contains five basic units, designed with interchangeable parts permitting more than 50 combinations tailor-made to individual specifications. Available in cart-, sled- or bench-type units.

Unique controls are vastly simplified. All components are visible and accessible. Adjustments can be made with a screw driver. Only heavy-duty industrial-type parts are used throughout each unit to insure dependable, long-life performance with minimum maintenance. Top-quality parts—"Square D" pneumatic timers, Mallory electrolytic condensers, Cutler-Hammer switches, Potter & Brumfield relays, Electrons, Inc. thyratron tubes. The SIGMATIC line is unquestionably a major welding advance—with one rugged, durable machine, you can do any type of "Mig" welding in any position on any thickness of any metal. For more information or a live demonstration, call your nearest Linde office.

"Linde," "Sigmatic" and "Union Carbide" are registered trade marks of Union Carbide Corporation

LINDE COMPANY

UNION CARBIDE

Division of Union Carbide Corporation
270 Park Avenue, New York 17, N.Y.

About NWSA

by
V. B. ANDERSON
president
National
Welding Supply
Association

Today's welding supply distributor is different than he was 5, 10, or 15 years ago. One of the major reasons: He is eager to comply with the demands of the many variations in the fabricating industry that have taken place during these past years. And, he helps himself.

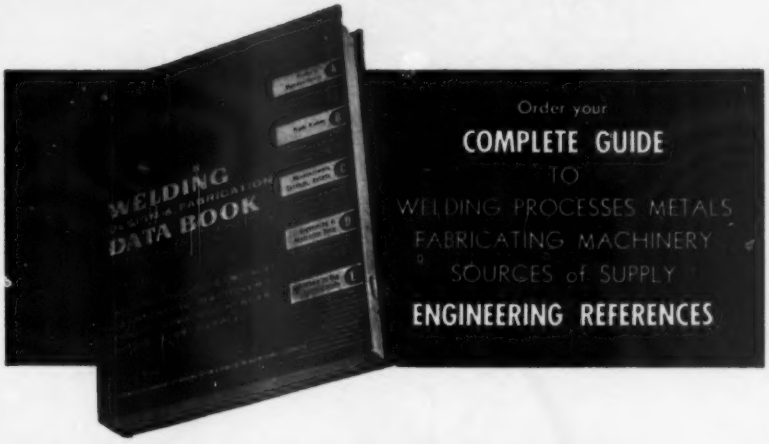
In 1945, a few forward-looking agressive distributors recognized the need for a medium through which all distributors could learn and plan for their future growth. These men could see that each distributor must be flexible in his thinking and in his efforts if he is to properly care for his customer. They knew the welding supply industry could become an important phase of industry only through a cross section of ideas.

This is how the National Welding Supply Association was born. Also included in the Association are the manufacturers and principal suppliers of the distributor members. Through the combined efforts of the initial members, they developed the prime "Purposes and Objectives" of the Association. They also developed a "Code of Ethics" which each member displays.

His association with NWSA helps the distributor better understand his relationship with his customers and his responsibilities to the industry at large. He and his suppliers have trained and qualified his own

continued on page 24

931 PAGES OF VALUABLE WELDING INFORMATION



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SOUTHWEST DIV: GARLAND (DALLAS COUNTY), TEXAS

RW-25

For More Information Circle No. 15 on Reader Service Card.

ABOUT NWSA

continued from page 23

organization so it can give expert and immediate attention to his customers.

The distributor today feels he has done a great deal to earn his position and his recognition. And, he feels his customers should be thanked for being patient while he learned more about their specific needs. He feels our annual billion dollar market (a 40 percent increase over five years ago) indicates there was cooperation and understanding by all concerned in the fabricating field.

Today, our members have set their sights to meet another major market increase over the next five years. This presents a challenge and places a big responsibility on the welding supply industry. This in turn calls for a continuing degree of understanding and cooperation from everyone concerned to keep abreast of new requirements.

The National Welding Supply Association today offers the most important avenue through which each distributor can have a voice in our "Purpose and Objectives" and can further his understanding in the obligations of properly serving his community—and his country. • •

American Brass Is Now Anaconda American

WATERBURY, CONN.: The American Brass Company, one of the nation's largest copper and brass mill product manufacturers, has changed its name to Anaconda American Brass Company. The change was made to follow a company trend toward advertising, marketing, and packaging its products under the Anaconda brand name.

Lincoln Foundation Makes Welding Awards

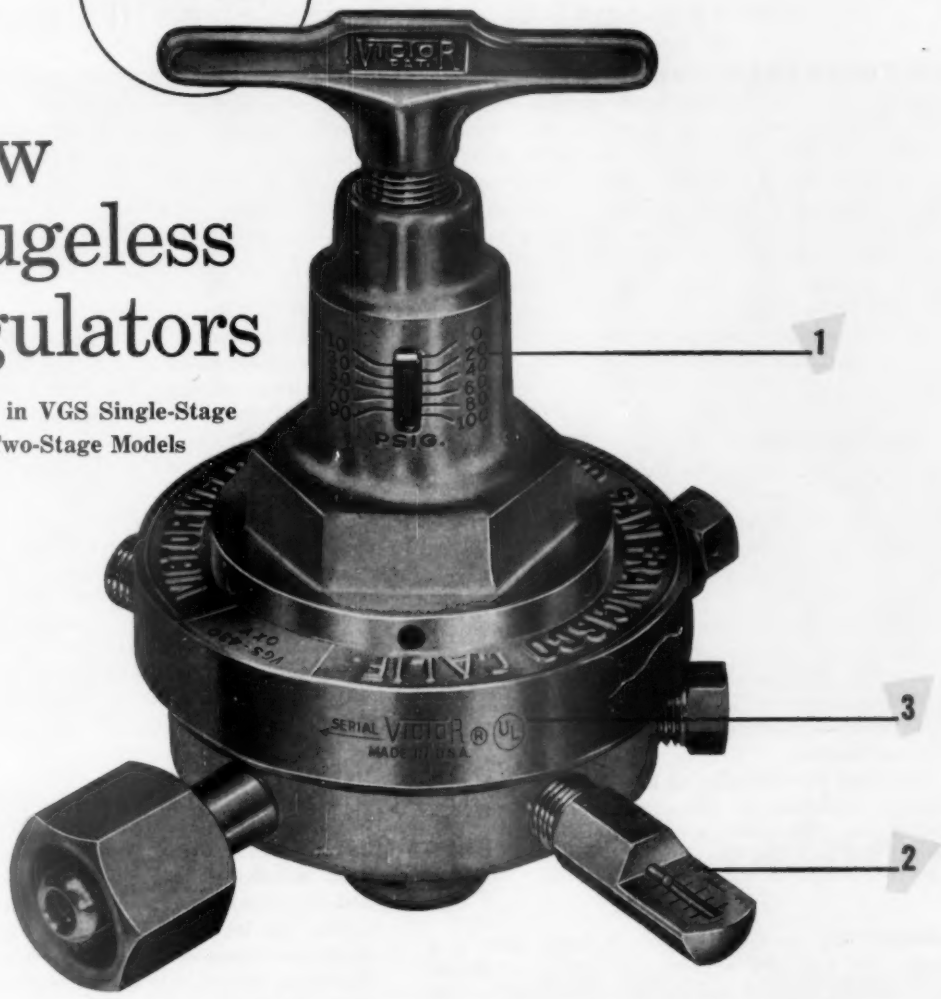
CLEVELAND: Led by Lowell Depping of Walla Walla, Wash., 107 farm boys from 22 states shared cash awards ranging from $25 to $600 each in the annual national welding competition for vocational agricultural students sponsored by the James F. Lincoln Arc Welding Foundation. The Foundation annually awards a total of $7,000 to students and high schools for shop projects involving welding.

more news on page 70

VICTOR

New gaugeless regulators

Available in VGS Single-Stage or VGT Two-Stage Models



1. Delivery pressure adjustment
- —Simple and easy to adjust
- —Readable on two sides
- —Bold pressure readings stamped in cap
- —Bright, easy-to-read pressure indicator

2. Inlet pressure indicator
- —Enclosed and protected piston-type
- —Clearly marked Full to Empty scale stamped permanently into metal
- —Reliable 'O' Ring Seal

3. Listed under Reexamination Service of Underwriters' Laboratories, Inc.

The VGS400 series single-stage and VGT400 series two-stage regulators embody all of the time-tested and field-proved design characteristics that have made VICTOR Safety Regulators the choice of the man on the job. The use of pressure indicators instead of pressure gauges provides increased service for hard usage applications. Order from your Victor dealer.

Single-Stage Models		Two-stage Models	
VGS430-967	0-100 psig	VGT430-967	0-100 psig
VGS410-970	0-15 psig	VGT410-970	0-15 psig

72

VICTOR for regulators

VICTOR EQUIPMENT COMPANY *San Francisco, California*
Los Angeles, California, Chicago, Illinois

MFRS. OF HIGH PRESSURE AND LARGE VOLUME GAS REGULATORS; WELDING & CUTTING EQUIPMENT; HARDFACING RODS; BLASTING NOZZLES; COBALT & TUNGSTEN CASTINGS; STRAIGHT-LINE AND SHAPE CUTTING MACHINES; ROLLER AND IDLER REBUILDING MACHINES

For More Information Circle No. 71 on Reader Service Card.

WELDING MANAGEMENT

watches these developments

THE DESIGN LAG in resistance welding equipment that gave American manufacturers an edge over their European counter-parts no longer exists. This disclosure was made by F. B. Jacob, assistant to the president, and H. W. Stieglitz, vice-president-engineering, of Thompson Electric Welder Co., Lynn, Mass., after a six-country European tour, including plants in Germany, Switzerland, Belgium, France, England, and Scotland. They acknowledged that resistance welding has become an indispensable tool in European mass production methods and has been integrated into high volume production lines.

A NEW WELDING FLUX makes possible the use of submerged arc welding in the construction of submarine hulls, according to a Battelle Memorial Institute report. The experimental flux was developed when high oxygen contents and numerous silicate inclusions were found in submerged arc welds on HY-80 structural steel prepared in shipyards. Reducing oxygen and the number and size of inclusions improved the welds, Battelle technologists report.

The flux developed gives excellent welds. It is less acid than ones now in use, because it contains relatively little silica and an exceptionally large amount of calcium chloride.

Plans call for evaluation of the flux under semi-production conditions in the near future. Meanwhile, studies are being made to determine why the experimental flux provides better welds.

J-GROOVES can now be made in heavy plate in a single pass with new oxy-fuel gas cutting equipment developed by Linde Company and announced at the Fall Meeting of the American Welding Society. The manufacturer says the process is most efficient on plate from ½ to 6 inches and makes joints comparable in quality to machined joints. It makes in 10 minutes a groove that would take 14 hours to machine.

THE COMMON STOCK of Englehard Industries, Inc., Newark refiner and fabricator of platinum metals, has been listed for trading on the New York Stock Exchange. The stock—privately held until June of this year—opened at 23. The ticker symbol is "ENG".

SOME OF THE TOUGHEST steels known are now being produced in thin-gage sheet and strip by U. S. Steel Corp. Formerly available only in plate form, 3/16 inch thick and more, these thin steels are heat treated (quenched and tempered) grades usually specified where extreme strength and toughness are needed. Tentative size limits call for thickness ranging from 1/10 to 3/4 inches, widths from 15 inches minimum to 96 inches maximum, and lengths up to 360 inches. Plates, sheet, and strip will be furnished in flat form only.

A NEW PLAN making plastic wire spools returnable has been announced by Air Reduction Sales Co. Airco will accept for credit its standard 4-by-12 inch plastic spools from customers at a price of 40 cents each, in lots of 72 spools (freight prepaid to Arcrods, Sparrow Point, Maryland). Broken, deformed or cracked spools are not acceptable.

USING SECOND-HAND grinding wheels is false economy, according to the Grinding Wheel Institute. The Institute's Industrial Information Committee points out that re-use of grinding wheels from one machine to another at different diameters, as well as using salvage or surplus wheels, seldom results in the intended savings. And, it frequently causes unsafe grinding conditions.

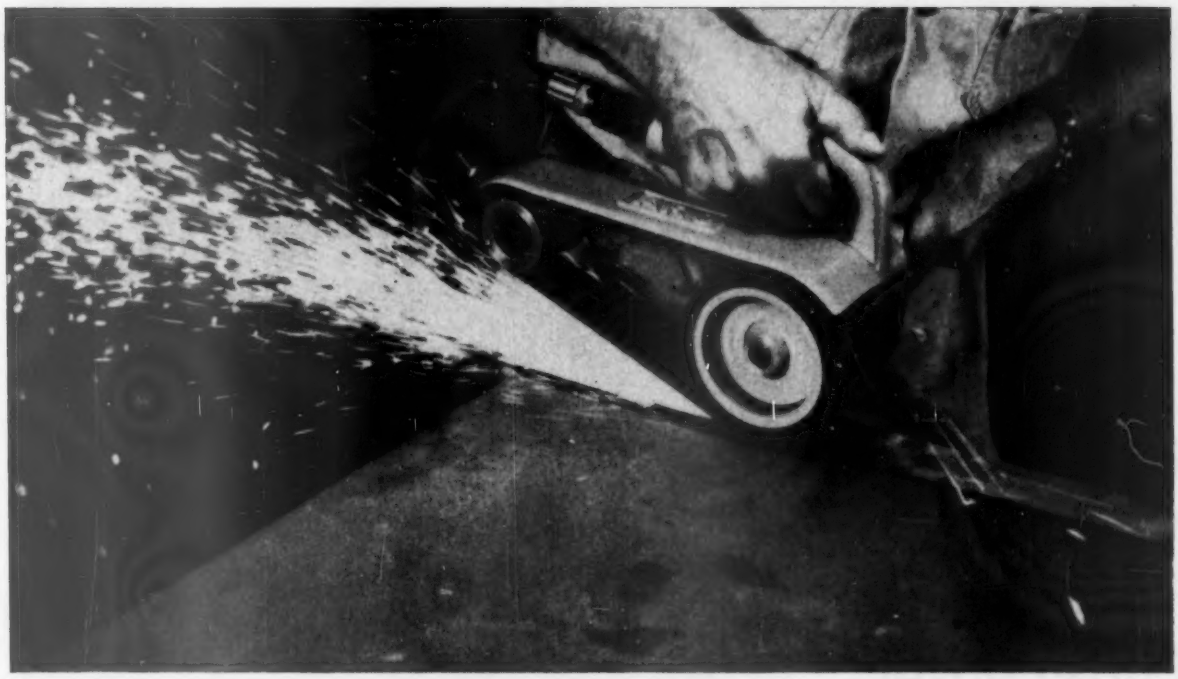
A CONTRACT for the development of high performance solid propellant rocket motor cases has been awarded to the Budd Company, Philadelphia. The program will extend over a three year period and will cost three-quarters of a million dollars. It will center around the investigation of new high strength materials and advanced methods of fabrication. From the knowledge gained through its research and development, Budd will build a full scale prototype rocket motor case.

RESISTANCE WELDING equipment shipments for August went above the 2½ million mark for the fourth month this year, according to the Resistance Welder Manufacturers' Association. It was the seventh month in which shipments were above $2 million. At the end of August, shipments for 1960 showed a 16 percent increase over the first eight months of 1959.

LINDE WILL TRIM ITS CYLINDER LINE according to W. B. Nicholson, president of Linde Company, Division of Union Carbide Corp. He said the company was giving up the manufacture and sale of cylinders for propane, refrigerant, and anhydrous ammonia service in order to expand production of a number of cryogenic products.

TOTALLY NEW AIR TOOL

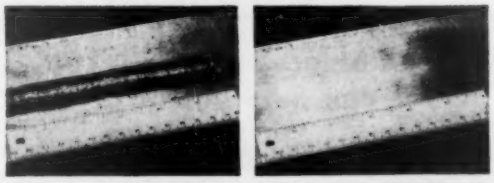
Hogs, Blends, Finishes Metal Faster!



ARO Portable Belt Grinder

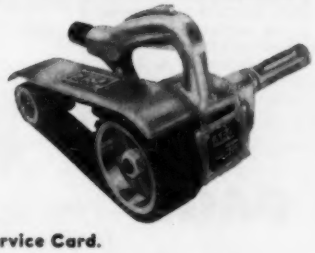
You're looking at a new ARO Belt Grinder in action. In this all-new production tool, Aro has combined the backstand idler principle of abrasive grinding with *portability* and *power* to remove metal faster. Live action of the coated abrasive belt running at high speed over slotted, resilient rubber contact wheel sets the abrasive grains "on edge" to give more bite. The metal is actually *sheared* off! Action is smooth and true—no chattering, bumping or bouncing. And you can rough grind and finish in one operation, because the abrasive belt method doesn't leave gouges or swirls in the work. Free belt stropping of corners and radii is easy, too. Beat high grinding costs with new Aro Belt Grinders. Job test one. Ask your Aro Distributor.

Cuts Metal like Butter!



1 Take a rough 6" weld like this. Put a powerful Aro Belt Grinder on the job, and take the grind out of grinding! Full 2 H.P. air motor running at 6000 R.P.M. produces 7000 S.F.P.M. Belt speed—you hog and finish in one operation.

2 Here's the result just 1¾ minutes later, using a 24-grit belt. This is typical of the outstanding performance you can expect from the new portable Aro Belt Grinder—only tool of its kind—unbeatable for grinding performance.



ARO®

AIR TOOLS

AIR HOISTS • AUTOMATION TOOLS
ULTRASONIC CONTROLS

THE ARO EQUIPMENT CORPORATION
Bryan, Ohio

Aro of California, 3141 S. Grand Avenue, Los Angeles 7, California; Aro Equipment of Canada Ltd., Rexdale (Toronto), Ontario
Offices in all Principal Cities

For More Information Circle No. 16 on Reader Service Card.

On production line welding at Parish Div. of Dana Corporation

UNIFORMITY OF PAGE WIRE CUTS DOWN-TIME

These Folders can help you

Write for:
Folder DH-402-C
Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

500# Payoffpaks of PAGE welding wire provide continuous feed with no down-time for reel or coil changeovers at Parish Pressed Steel Division of Dana Corporation. Those shown above, for instance, feed CO_2 welding machines used to produce motor mount members of automobile frames.

As a major automotive supplier, Parish demands uninterrupted production of extremely high quality. Parish specifies PAGE welding wire not only because they can get the correct wire analysis, but also because PAGE wire offers uniform temper and finish plus consistent metallurgical characteristics. These factors, combined with the right packaging, help Parish maintain quality, minimize down-time.

Let PAGE help solve your welding problems • From PAGE, you get over half a century of wire drawing experience and leadership in metallurgical research. From 33 welding wire analyses, PAGE can furnish the right wire for your job. Every modern form of packaging is available for convenient storage and handling. Prompt delivery is assured by a coast-to-coast network of PAGE distributors and warehouses. Bring your welding problems to PAGE—we'll be glad to help you improve your quality and lower your production costs.

ACCO

PAGE WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.
Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.
Indicates PAGE warehouse stocks

PAGE—*THE SOURCE FOR ANSWERS TO WELDING PROBLEMS*

For More Information Circle No. 54 on Reader Service Card.

with the new

VICKERS®
Controlarc®

This latest addition to the Vickers Controlarc line offers something new in welding—combining the advantages of three-phase rectifier type welders with AC-DC output, both in one outstanding machine. Controlarc circuits utilize three-phase power to provide *both* the AC and DC outputs. And there are many other benefits to be found in this new welding machine from Vickers.

FOR COMPLETE DETAILS, WRITE FOR NEW BULLETIN 7206-3
Some Territories Open to Qualified Dealers. Write Today.

- Excellent AC performance *and* same high quality DC performance, through duplicate circuitry of existing three-phase Controlarc
- Wide output range—6 to 400 amperes DC, 6 to 250 amperes AC in this Controlarc 330 (300 ampere unit)
- Full single range operation on AC and DC permits use of standard Vickers slope controller without limitation due to range switches
- Special low range AC for high performance low current TIG and stick electrode welding. (Low current resistor available for test lab and experimental welding.)
- Dual continuous control on both AC and DC. Arc control provides adjustable arc characteristics (curve slope and response speed) on both AC and DC
- Selective arc starting circuitry (with on-off switch) operates on both AC and DC. Standard on all designs
- Built-in gas and water controls; high-frequency arc starter is located external to welder to permit placement in proximity to work
- Standard Vickers *foot* control units and *dual remote* hand control units adjust both AC and DC output currents.

VICKERS INCORPORATED
Division of SPERRY-RAND Corporation

ELECTRIC PRODUCTS DIVISION

1855 LOCUST STREET
SAINT LOUIS 3, MISSOURI

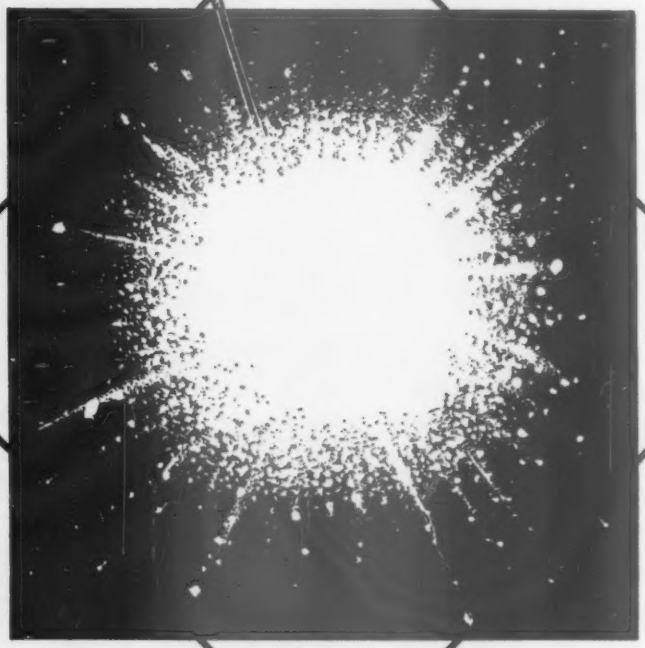
EPA 7200-1

For More Information Circle No. 70 on Reader Service Card.

Having Welding Troubles?

ASK FOR TROUBLE FREE HI-AMP

Profit-conscious companies from coast to coast have discovered that trouble free **HI-AMP** electrode holders and accessories cost them less, while serving them better. Many purchasing agents have effected annual reductions which are substantial by switching to **HI-AMP**. Your distributor will demonstrate how **HI-AMP's** cool, trouble free operation will enable you to buy more suitably, as well as economically. See your **HI-AMP** distributor without delay.



Insist On HI-AMP Accessories From Your Welding Supply Distributor

LENCO, Inc. JACKSON, MO.

For More Information Circle No. 43 on Reader Service Card.

NOVEMBER, 1960

Welding Design & Fabrication

Does A Radiographed Vessel Cost More To Build Than One That Isn't?

by **ROBERT CHUSE,** *consulting engineer*

IN BRIEF: Some pressure vessel builders still believe that radiography takes money out of their pockets. An expert disproves this notion and proves that radiography is an economic necessity.

THE NEW Section 8 (Jan., 1960) of the ASME Unfired Pressure Vessel Code contains major changes in welded joint efficiencies. The code now allows 100 percent efficiency for fully radiographed, double-welded longitudinal joints, 85 percent efficiency for spot radiographed joints, and 70 percent for joints that are not radiographed at all. This means that a fabricator who radiographs can build a code vessel much faster, use thinner plate and less weld metal, than one who does not. The radiographed vessel will be easier to handle, cheaper to ship, and will have much better welds. These features not only attract customers, but they are often required.

Some thick-wall pressure vessels require stress relief. In many cases, the designer can avoid stress relief by designing for radiographic inspection. This permits him to use thinner walls, less than required for stress relieving.

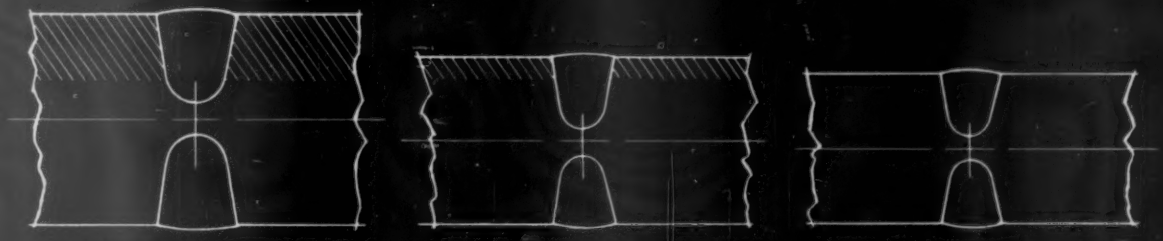
The table (page 33) compares the cost and weight of three code vessels: fully radiographed, spot radiographed, and without radiography. The vessels are 60 inches O.D., double-butt welded, and designed for 200 lb. pressure. Each has two 8-foot courses, and two torispherical heads.

The vessels will contain no corrosives in service,

continued on next page

WHAT JOINT EFFICIENCY MEANS

. . . in plate thickness . . . in weight . . . in weld metal



A / NO RADIOGRAPH (70% Joint Efficiency).

B / SPOT RADIOGRAPHY (85% Joint Efficiency)

C / 100% RADIOGRAPHY (100% Joint Efficiency)

A CODE VESSEL made in three joint efficiencies will have these plate thicknesses and weights. The fully radiographed vessel (Joint C) will be about 30 percent lighter than the non-radiographed vessel (A), 10 percent lighter than the spot radiographed vessel (B). Weld metal will be proportionately smaller too.

so no allowance is made for corrosion. But remember, code paragraph UCS 25 requires a corrosion allowance be made for radiographed vessels that will contain air, steam, or water. If the vessel is not to be radiographed, figure the thickness of parts not involved in weld joint efficiency on the basis of 80 percent of the allowable stress. Also, the size and thickness of opening reinforcements must be figured at no more than 80 percent of the allowable stress.

Code vessel fabricators must satisfy the requirements of the code at the least cost.

How much will a commercial radiographer, that comes to your plant, charge? It depends on the number of vessels he does in a visit. For example: He'll charge about $4.00 a foot or $7.50 a spot to radiograph several vessels, considerably more for just one or two vessels, and considerably less (as much as a third) for a production job. These prices are about the same all over the U. S.

If your own employees do the work with your equipment, 100 percent radiography will run about $2.50 a foot or $6.00 a spot.

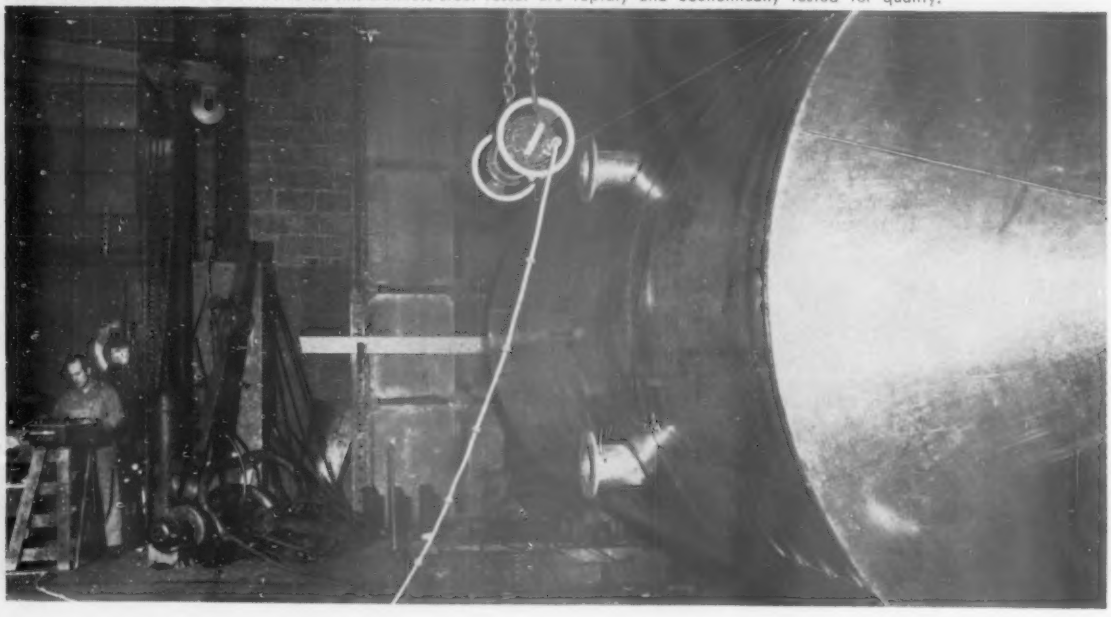
In this comparison, we use the figure most plants use to estimate repairs on radiographed vessels—5 percent. This includes removing the defective welds, rewelding, and radiographing the repairs. We've omitted charges such as material and labor markup, commissions, profit, and inspection costs. These charges vary from plant to plant and would only cloud the comparison.

In the cost comparison, the spot-radiographed vessel is the cheapest to build. The lighter, fully-radiographed vessel is the cheapest to ship. These results show that radiography is almost an economic necessity for code vessel fabricators. • •

Mr. Chuse is also the author of *Unfired Pressure Vessel, The ASME Code Simplified,* published recently by F. W. Dodge Corp.

FULL RADIOGRAPHY: The neck of this vessel is being X-rayed in one exposure with a portable, 360° unit.

SPOT RADIOGRAPHY: Girth welds on this stainless steel vessel are rapidly and economically tested for quality.

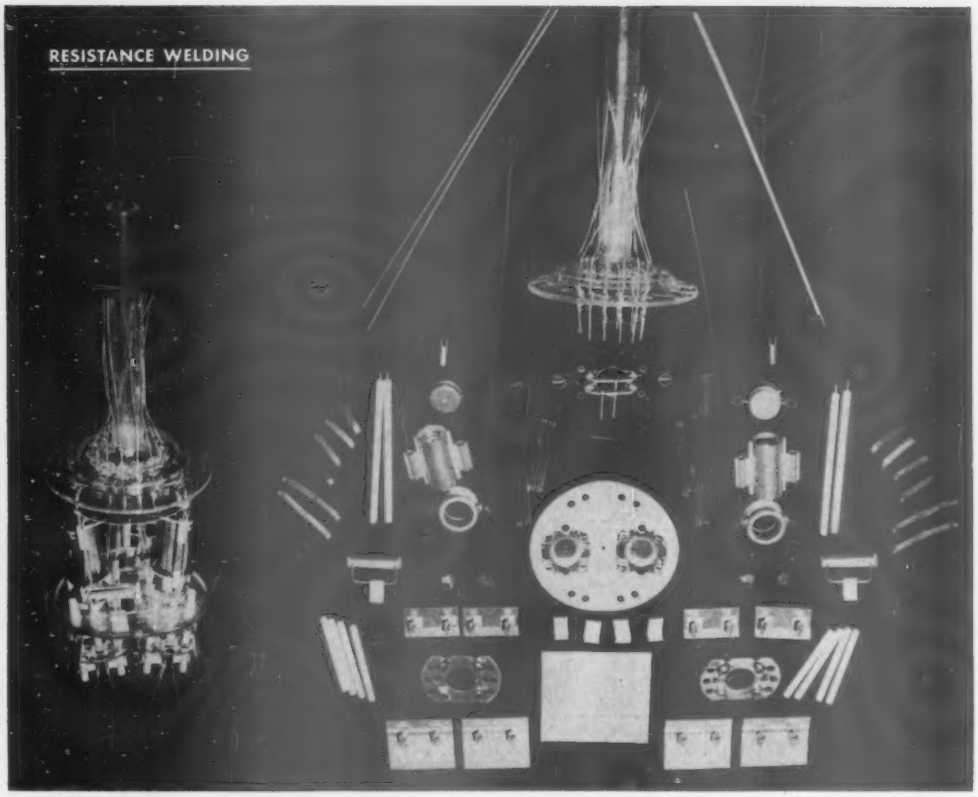


COST COMPARISON: RADIOGRAPHED AND NONRADIOGRAPHED CODE VESSELS

VESSEL DIAMETER-60 INCHES
MATERIAL-SA285 GRADE C
DESIGN PRESSURE-200 LBS.

JOINT EFFICIENCY ▶	Full Radiography 100%	Spot Radiography 85%	No Radiography 70%
Plate-Thickness, inches	0.4375	0.515	0.625
Plate-Area, sq. ft.	251.3	251.3	251.3
Plate-Weight, pounds per sq. ft.	17.85	21.037	25.5
Plate-Weight, lb.	4500	5320	6425
Plate-Cost, 7¢/lb. average	$315.00	$373.00	$450.00
Head-Thickness, inches	0.75	0.75	0.875
Head-Weight, lb.	1544.00	1544.00	1800.00
Head-Cost	$266.00	$266.00	$306.00
Weld Rod, weight per ft.	0.73	0.86	1.13
Weld Rod, weight lb. main seams 63 ft.	46.00	54.00	72.00
Weld Rod-Cost @ 18¢/lb.	$8.30	$9.75	$12.95
Feet Of Joint Welded per hour @ 10 ft. per 1/8 in. of thickness	2.85	2.45	2.00
Labor Cost per ft. of weld @ $3.50/hour	$1.23	$1.43	$1.75
Labor Cost - 63 ft. of weld	$77.50 *	$90.00 *	$110.00
Welding Time, hours	22.0	25.7	31.5
Overhead On Welding Time @ $4.00/hour	$88.00 *	$106.00 *	$126.00
Radiography Cost @ $4.00/ft; $7.50 spot x-ray	$252.00 *	$15.00 *	0.
Layout-Cost	$30.00	$30.00	$30.00
Burning-Cost	$52.50	$52.50	$52.50
Rolling-Cost	$22.50	$22.50	$22.50
Fitting-Cost	$67.50	$67.50	$67.50
Chipping Or Grinding-Cost	$30.00	$30.00	$30.00
Testing-Cost	$30.00	$30.00	$30.00
TOTAL WEIGHT, lb.	6090	6918	8297
TOTAL COST	$1239.30	$1092.25	$1237.45

* Estimated cost of repairing weld defects - 5%



ELECTRON BEAM GUN is made up of 175 metal and ceramic parts. The finished assembly (left) is about the size of a 75-watt light bulb.

Spot Welding Is The Key To Reliable Miniaturized Electronic Parts

IN BRIEF: Spot welding is a precision process that is ideal for assembling the many minute dissimilar metal parts found in electronic components.

A TYPICAL JOB for the electronics industry is welding an electronic gun, the active element in a cathode ray tube. Not only do you find these tubes in television sets, but there are hundreds of specials for radar, sonar, data processing, and electronic test gear. One of these specials has an electron gun assembly that emits two streams of electrons instead of one. A tube with one of these dual guns can display simultaneously information from two different sources. Hughes Aircraft Company's Vacuum Tube Products Division, Oceanside, California, produces a variety of these dual-electron-gun tubes. And it has developed the intricate spot welding techniques that are now considered routine.

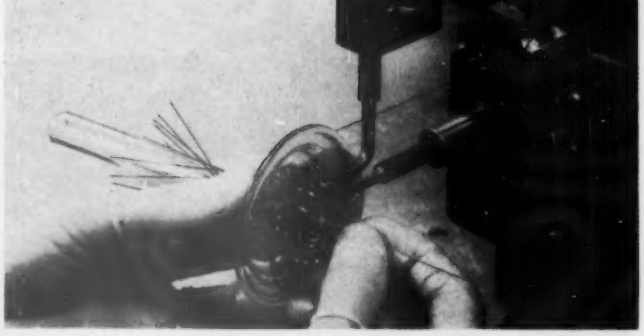
METALS AND WELDING EQUIPMENT

The materials going into the gun assembly are Types 304 and 305 stainless, nickel, dumet, copper, and tungsten. These are used as wire or sheet from 0.0025 to 0.040 inches thick. The finished gun is about the size of a man's fist, contains 175 different parts joined by almost 1,000 spot welds.

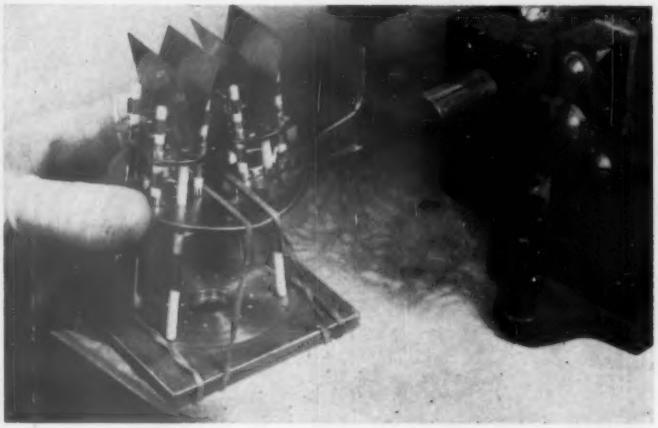
Operators assemble the entire gun with two special welding heads equipped with custom-made electrodes. Both heads are controlled by a single control. It is Hughes' VTW-501, adjustable from 2 to 20 cycles. Phase shift heat control gives the low heat settings needed for delicate work with instantaneous switching to full power output (2.5 KVA at 240 V, 5.0 KVA at 480 V) for thicker materials.

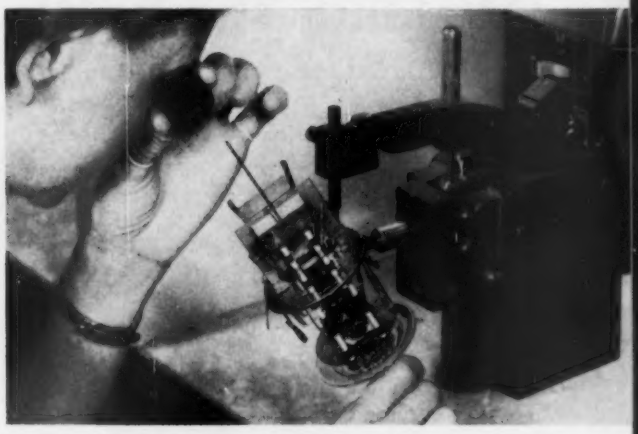
HOW THE DUAL BEAM GUN IS MADE

Technicians build the dual beam gun in stages, starting with the glass stem that forms the tube base. After a mica disc insulator is firmly fixed by nickel eyelets



GUN ASSEMBLY starts with the glass stem and the connecting wires. The operator (left) attaches a mica insulator to the leads with small nickel eyelets. When the operator positions the second and third discs (right), his view is blocked by the first plate. So, he does all positioning mechanically.





WITH ALL JIGS AND CLAMPS in place, the operator welds various plates and wires in place to complete the gun's main body. The completed gun gets microscopic inspection. Rubber fingers keep oil and sweat from contaminating parts.

to the base wires, the operator begins the tedious assembly of main sections of the gun. The lower section consists of 2 emitters, 2 anodes and 2 focus electrodes, all supported by 2 pairs of ceramic rods. The anodes, small stainless cylinders about 1½ inches long, appear deceptively simple. Each tube, however, contains three discs with minute center holes through which the electron beam passes.

Assembling the tube calls for three combination jig-electrodes. Each holds and welds each of three flanged discs. The first disc is easy to weld. The operator can see it and can easily position it. Feeler rods, however, position the second and third discs on the electrode because the operator can't see past the first.

The upper parts of the gun consist of four sets of deflection plates and the shields and discs that hold them in place. The angle of convergence of the two beams is important so precision jigs are used to space the parts. Jigs and parts are kept in close contact throughout welding.

In spot welding this section, the operator uses both welding heads. The difference between the two is the shape of the electrode tips. The head to the operator's left has a pointed-tip pair for welding flat metal areas with small spot welds. The right-hand head has blade tips for eyelets and wires needing more electrode contact area for a strong bond.

The parts of the sub-assembly are clamped together, using five different positioning jigs simultaneously. Then the operator welds in a definite sequence, with a specified number of spot welds for each location. Precise setting of the welding control and careful assembly techniques yield high quality.

After this major section is completed, it is attached to the anode cylinders already welded to the stem. A number of 3/16 inch ceramic rods support these sections and act as insulation at the same time. Metal parts are fixed to these rods by using U-shaped brackets that fit halfway around the rod. These are spot welded to mating brackets on the other side.

CAREFUL INSPECTION IS REQUIRED

Once the two sections are assembled, the jigs are removed and the entire unit is checked for alignment. This is done visually through a magnifying glass and mechanically by two alignment rods dropped through the deflection plates and the anode cylinder. These rods represent the two paths of the electron beams, so adjacent parts absolutely must be precisely located. Should a single deflection plate, for instance, be placed too close to the beam path, both plates making up the pair must be removed and new ones located correctly. To maintain overall tolerances sometimes calls for removing and replacing an entire section. A great deal

continued on page 51

TV And Tooling: Keys To Automatic Welding The B-70

IN BRIEF: North American Aviation developed new automatic arc welding techniques and equipment to join brazed steel honeycomb panel sections.

THERE WILL BE 19,000 feet of automatic arc welding in the B-70 Valkyrie jet bomber. This is much more than needed for any other airplane. North American Aviation's Los Angeles Division is developing the B-70.

DESIGN BACKGROUND

The design calls for automatic arc welding to join sections of brazed steel honeycomb panels. These panels are almost as strong as solid steel, but they are many times lighter, and they will resist the 600°F heat the bomber is expected to develop when flying at 2,000 mph. Joining them by automatic welding (tungsten arc inert gas shielded welding is the basic process) produces a simple, high-strength, fuel-tight structure.

WELDING PROBLEMS

North American used to do most of its automatic welding with the torch in a vertical position directly above the work. Longitudinal and circumferential seam welds were commonest.

B-70 structures are too large to rotate or to pass along under a fixed welding torch. So, North American developed new methods and new equipment to keep the work stationary and automatically move the torch precisely along path, making a sound weld in any position.

NEW WELDING EQUIPMENT

An oscillating device moves the welding head transversely to the carriage travel to get more uniform weld deposits.

A 16-foot stake welder automatically joins tapered sheets.

A manipulator (see cover) with 12-foot boom makes circumferential and longitudinal welds on shapes as slender as 20 inches in diameter. This machine has special features. One is closed circuit television that enables the operator to watch the weld as it is made. In some cases this eliminated the need for an extra welding crew member watching the welding and verbally relaying information to the machine operator. Another is an X-ray head that moves mechanically along the same guide rail that drives the welding head. This makes possible continuous in-motion exposure of strip film with no loss of definition.

AN ELECTRIC EYE follows a pattern and guides this unique automatic welder in making complicated joints.

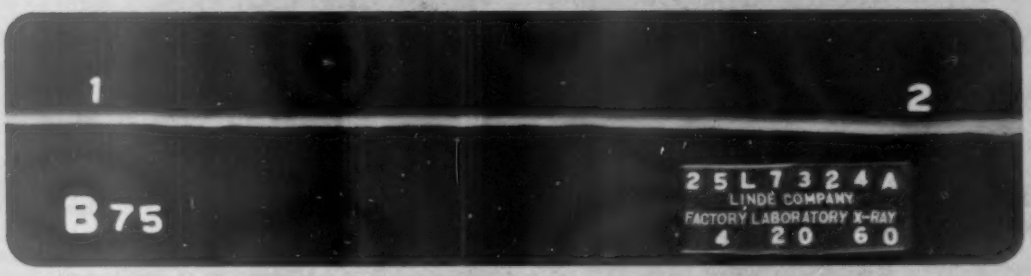
MANUAL WELDING

A great deal of manual welding will still be used in fabricating the B-70. This welding is conventional to a point. But, the demands for strength and close tolerances are felt here, too. Most critical are fuselage carry-through frames, rugged and accurate steel sections, that give the fuselage its shape. The many welds needed to join the pieces and hold stiffeners cause localized heating and warping.

This led to heating parts before or during welding and welding at elevated temperatures. In turn, this brought new problems of distortion, cracking, loss of strength, and heat treating. The solution was to develop techniques and jigs to heat the work properly, cool it down fast, and evenly enough to retain its strength and shape. • •

The Linde Oxygen Converter provides a far greater oxygen supply in 1/7 the space and 237 lbs. less weight than compressed-gas containers.

All the oxygen needed in 1/7 the space



Five-position radiographs on Kodak Industrial X-ray Film, Type AA, check the integrity of the Heliarc girth welds on this oxygen converter manufactured by Linde Company, Division of Union Carbide Corporation.

A high-flying airplane can now carry its oxygen supply in a Linde converter that weighs 237 lbs. less than the usual jumbo-sized cylinder and occupies only 7.9 cu. ft.

In making a container to carry liquid oxygen, Linde Company was faced with the problem of holding extremely high pressures and low temperatures. The problem was solved by using an inner and outer sphere with high vacuum as insulation in between. The seams are Heliarc welded and each proved sound by radiography with Kodak Industrial X-ray Film. With this assurance Linde has extended its 90-day guarantee on the vacuum insulation to a full year.

This is another example of the way radiography helps to further the use of the welding process, and increase the value of welded products.

X-ray testing can save your company time and money. Consult an x-ray dealer or write us for a Kodak Technical Representative to call.

X-ray Division **EASTMAN KODAK COMPANY** Rochester 4, N.Y.

Now in the NEW Ready Pack . . . Kodak Industrial X-ray Film, Type AA and Type M

- No darkroom loading—each sheet sealed in a light-tight envelope.
- Just place Ready Pack in position and expose—film protected from dust, dirt, light and moisture.
- In the darkroom—just pull the rip strip, remove film and process.

Kodak
TRADE MARK

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ASSEMBLY begins like this. Pre-fabricated or orange-peel sections are trucked to desert site, hoisted into stand, positioned, and welded. (Smaller tank, right, holds rocket fuel.)

OUT-OF-POSITION WELDING is commonplace. Operator (top) leans over rim of outer carbon steel shell and across annular space to weld exterior seam on stainless tank. Overhead

Leak-Free Welds Are The Key To World's Largest Stainless Steel Spheres

IN BRIEF: A 75,000-gallon low pressure tank and an 8,000-gallon high pressure tank hold liquid oxygen for air force missiles.

EVEN IN A BRIEF static test firing, a big liquid rocket engine has a tremendous thirst for liquid oxygen—LOX to the missileman.

When Rocketdyne, a division of North American Aviation, Inc., designed the largest liquid engine so far developed, delivering 1.5 million lb. thrust, LOX requirements became impressive.

TWO DIFFERENT TANKS ARE NEEDED

One test stand for the engine required a low-pressure tank holding 75,000 gallons. Another test stand needed a tank that would contain 8,000 gallons of LOX at 2,800 psi. They would be the world's largest low-temperature Thermos bottles.

One would be a 26-foot 10-inch diameter sphere of 13/16 thick stainless steel encased in a 30-foot diameter vacuum jacket of 9/16 inch thick carbon steel.

The other would be a smaller tank, but still the biggest of its kind. It would be a stainless sphere having a minimum wall thickness of 4-11/16 inches. Its vacuum jacket would be a shell of 1/2 inch thick carbon steel.

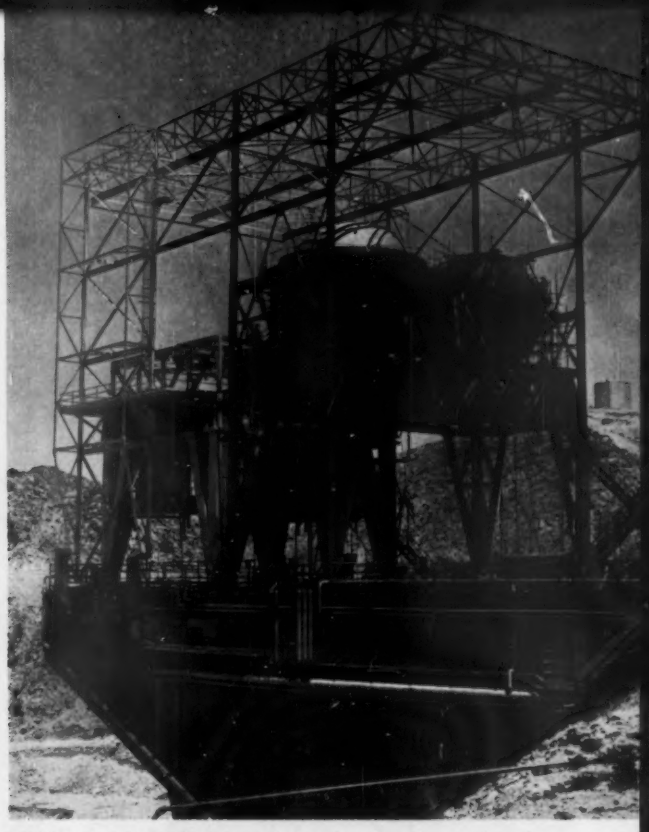
The only way to build them was by welding together orange peel sections. They would have to be welded manually to meet performance specifications never before applied to structures of their size. The spheres would have to be molecularly leak-free. They would have to pass mass spectrometer tests specifying "no detectable leaks".

The specs demanded welding the vacuum jackets with an excellence that the space could hold a test vacuum of 0.0004 inches of mercury and an allowable minimum operational vacuum of .0012 inches of mercury.

Successful bidder for the job was Southwest Welding & Manufacturing Co. of Alhambra, California. They have had years of experience in welding massive industrial tanks.

It was a pioneering job in stainless welding, pre-

welding (left, bottom) is used to attach plumbing fixtures. Dome of vacuum shell is positioned for final welding (above).



NEARING COMPLETION, 75,000 gallon liquid oxygen tank is at left in test stand. Stainless sphere is being enclosed in outer shell of carbon steel.

ceded by extensive testing to establish welding methods for the Type 321 stainless selected for the spheres.

Crack sensitivity of Type 321 demanded an electrode that would reduce cracking. At extremely low temperatures, the electrode also had to have ductility because the tank had to withstand vibration and irregular expansion and contraction of sphere metal and its stainless steel plumbing.

Southwest's researchers tried a wide variety of electrodes on test plates, and made Charpy impact tests after chilling them to —320°F. Finally chosen was a 19-9 Cb (AWS 347-15-Cb ELC) electrode, 19-chrome, 9-nickel and lime coated, specially modified to hold carbon to a maximum of .04% and having added ferrite control to a range of 4 to 8 percent.

FABRICATING THE SMALLER HIGH-PRESSURE SPHERE

Welding the smaller high-pressure sphere was simplified because the work was done in the shop. This was also done in the shop because the completed container had to be stress relieved because of its unusually deep welds.

The sphere was placed in an annealing oven, heated to 800°F and held for five hours. Heat was then raised to 1850°F and held for another five hours, after which the sphere was removed and air quenched.

LARGER, LOW-PRESSURE SPHERE

The larger, low-pressure sphere needed no annealing. Southwest assembled it at the test site, by hoisting the prepared sections into the test tower and welding. In theory it was a good assembly technique, but it proved costly in welding downtime, as desert winds stopped all welding. The wind blew hard enough sometimes to make it impossible to get good welds. During the three months of assembly, Southwest lost more than 2,000 manhours of welding time to wind.

Another difficulty: Despite low humidity of the desert, often as low as one percent, electrode coatings still picked up moisture. It was necessary to store the electrodes in an electrode drying and stabilizing oven until just before using them.

Welding operators were selected carefully for assembling the big, low pressure tank. But, once qualified, they had free choice of the method for depositing welds. Stringer beads were preferred, but weaving was allowed.

Specifications demanded progressive X-ray inspection. Any evidence of inclusion or porosity called for grinding out and rewelding.

COMPLETION OF THE LARGER SPHERE

Then came the final process step that will be a standard chore in the welding of cryogenic containers, especially those for liquid oxygen.

The inside of the tank must be scoured thoroughly, washed clean, and passivated to rid the surface of anything that might react with the liquid gas.

continued on page 40

PORTABLE PRECISION IN ULTRASONIC WELD INSPECTION

THE NEW BRANSON SONORAY® MODEL 5

for inspection of raw materials going into weldments, as well as of the finished weld itself, goes with you to the job wherever it may be . . . brings laboratory precision into the field and permits the most accurate evaluations of internal structure possible today. Simplified controls, easily mastered by non-technical personnel, are centralized on the front panel. Skilled service by factory-trained specialists is always available across the nation.

PORTABLE: Weighs only 37 pounds complete.

SENSITIVE: Detects all cracks; instrument response adjustable to suit exact quality requirements of any job.

PRECISE: Completely locates, and determines extent of, internal discontinuities.

ECONOMICAL: Costs $2750.

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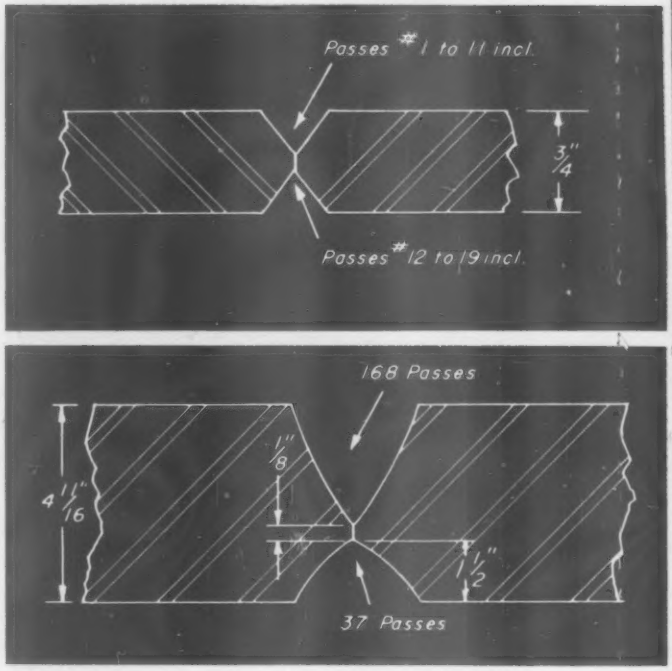

JOINT DETAILS here are for 75,000-gallon low-pressure tank (top) and for an 8,000-gallon high-pressure tank for another test stand (bottom). When the containers were completed 2,500 lb. of weld metal lay in the joints of the big tank, and 12,000 lb. in the small. Where 12-inch diameter forged stainless collars were inserted to secure piping for nitrogen pressurization, 400 passes were required to fill a depth of 11½ inches.

Here is the schedule Southwest used:

1. Sandblast interior and remove all sand.
2. Wash thoroughly with trichloroethylene.
3. Pickle 30 to 80 minutes at 70° to 100°F with 20% to 45% solution of nitric acid and water.
4. Wash thoroughly with water to remove all acid stains or discoloration.
5. Neutralize with 10% commercial caustic soda.
6. Wash thoroughly with demineralized water.

Following the cleaning and inspection of the tank interior, the 18-inch space between the sphere and its jacket was filled with oven-dried Perlite insulation and sealed for vacuum testing. The tank was half-filled with LOX after stabilization of vacuum at the test rating of 0.0004 inches of mercury. They measured LOX loss which could not exceed 300 gallons in 48 hours.

WHAT'S IN THE FUTURE?

Southwest is now constructing a second 75,000-gallon LOX container for another Rocketdyne test stand. Will this be the largest practical size for cryogenic tanks?

Warren Vetter, chief engineer for Southwest Welding, does not think so. Vetter thinks that today's big low-pressure vacuum tanks may be dwarfed by future containers for liquid oxygen as existing rocket engines are tested in clusters, or larger engines make their appearance.

Mr. Vetter thinks the only limitations on high-pressure tanks may be imposed by the wall thicknesses that can be welded successfully. • •

alloys for outer space

Solving the difficult problem of joining light metals for outer space vehicles is just one of many new uses for TIG welding. And for this kind of critical application, no finer Tungsten Electrode is made than by Sylvania.

Sylvania makes every kind of Tungsten Electrode available: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. And each comes in the desired finish—cleaned or ground, and color-coded to save valuable time, prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.

There's a Sylvania Tungsten Electrode for every welding need.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

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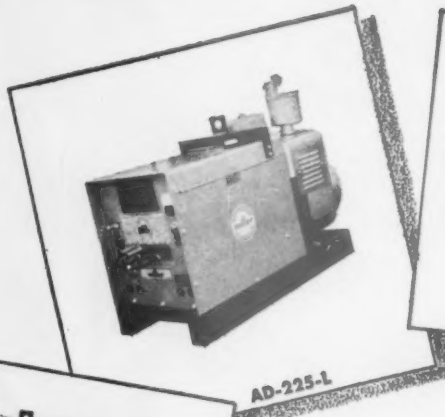
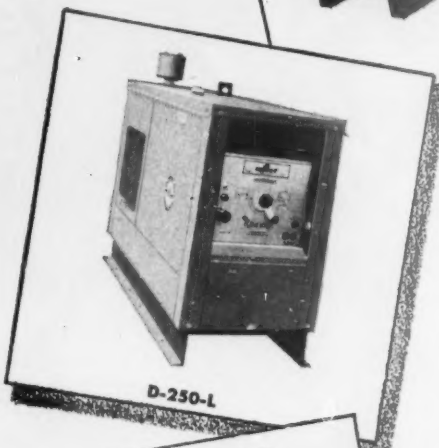


AD-225-L

D-250-WE

AEA-200-LE



D-250-L

FIRST and FINEST FAMILY of WELDER/POWER PLANTS

Miller was one of the first with a successful combination welder/power plant. This established a lead never lost notwithstanding the most widespread efforts at copying and duplication. Shown here are gas and diesel engine driven welders in d-c and a-c/d-c models.

In this group there is a welder/power plant size, type and price to meet every practical need—all available with field-tested accessories and trailers.

DD-250

DA-300-L

DAH-350-L

Complete specifications will be sent promptly upon request. Please indicate model or models.

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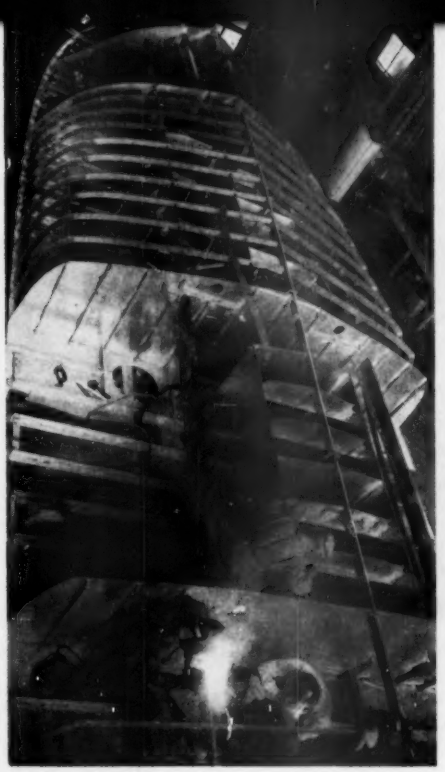
Sea Will See More Aluminum Boats

. . . they'll go faster, run cheaper, carry more, and last longer



DRESS PLATES, remove excess weld, with fast weld shaver.

BAND SAW beveled ribs fit hull plates without fill-in welding.

TWO WEEK'S WORK in aluminum, a month and a half in steel.

IN BRIEF: There's a trend towards welded aluminum for medium tonnage boats. Here's how the largest aluminum passenger boat in the U. S. was built.

A 65 FOOT ocean craft being built by Chaffee Machine Co., San Diego, has the interest of West Coast shipbuilders and welding fabricators. It is the largest all-aluminum all-welded passenger boat ever built in the U. S.

It will ferry 118 passengers at 21-knot clip. In speed and payload, it will show its stern to boats of other construction, but just as big. And it took less time to build the aluminum boat.

With construction well underway (see photo) five men worked only thirteen 8-hour shifts. Company president Tod Chaffee says: "A steel hull would have taken a month and a half to get this far. Finished, our boat will weigh only 21 tons. A comparable steel boat would weigh 67 tons, and have a hard time hitting a 15 knot cruising speed.

Marine architects believe the ferry will start a trend in welded aluminum boats of medium tonnage. Aluminum boats may cost more than steel ones, but they'll go faster, run cheaper, carry more, and last longer. Chaffee's supplier, Kaiser Aluminum & Chemical Sales, Inc., feels so strongly about aluminum boats, they've assigned Engineer Melvin M. Tilley to work with Chaffee on welding techniques.

Tilley insists on these welding steps:

1. Wire brush weld joint. Chaffee uses a 0.010 stainless steel brush turning at 2,500 sfpm.
2. Clean off oil with acetone, wipe dry.
3. Clean joint with etchant that dissolves oxide and metal particles. Let etchant react 3 minutes, then wipe dry.
4. Weld quickly to prevent moisture pickup.
5. Weld in a draft-free room. For consumable inert-gas welding (used by Chaffee) shield arc with at least 50 cfh of argon, 55 cfh, if there are drafts.
6. Protect aluminum against moisture.

Tilley says: "It's not hard to make Class C, or even, aircraft C-1 welds, and get Coast Guard approval with these procedures."

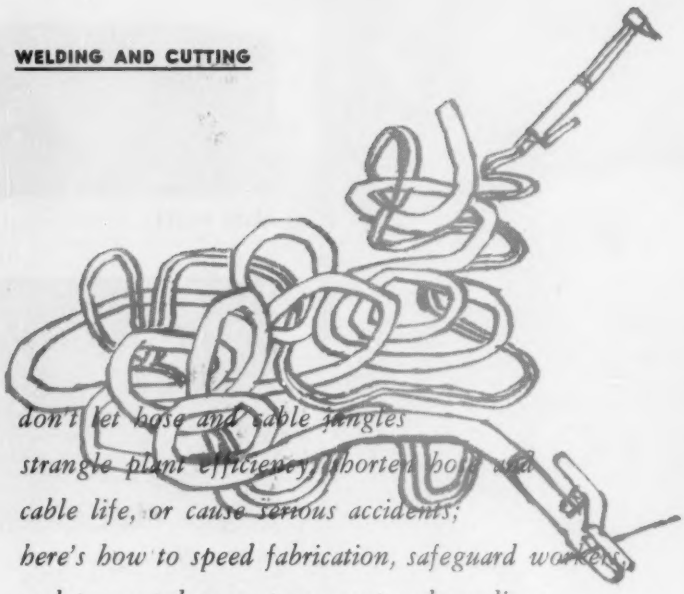
Tilley explains the need for draft-free welding and above-normal argon flow: "Argon must shield the arc from air. If it doesn't, moisture releases atomic hydrogen which combines with the aluminum. During cooling, the hydrogen becomes molecular and a source of porosity."

Here are some Chaffee tricks that will help you build aluminum boats:

- You don't need backup bars.
- Use a weld shaver to remove weld buildup fast and to dress plates before welding.
- Bevel ribs on a band saw. They'll fit flush and match the curve of the hull plates.
- Carry welds thrugh the joint. Use temporary plates, if necessary, to extend the weld.
- Avoid undercutting in welding ribs to hull plates by notching the ribs. This makes a continuous weld around the rib end.
- Avoid warping plates with long joints by welding alternately at opposite ends of the work. Experiment to establish the length of the skip-welds.

Chaffee used 5086-H-32 aluminum alloy for all structural members of the ferry in $\frac{1}{8}$- to $\frac{3}{4}$-inch thicknesses. They used 5356 weld wire in 3/64- and 1/16-inch diameters. They used 230 amps for welding heavy plate.

Chaffee welded with consumable inert-gas because it was fast and deep-penetrating. It was the best for their continuous, single-pass welding. • •



don't let hose and cable jungles strangle plant efficiency, shorten hose and cable life, or cause serious accidents; here's how to speed fabrication, safeguard workers and prevent damage to current and gas lines . . .

FIXED MOUNT There's enough hose on this reel to reach a lot of work. When the job's done, the hose (or cable) is out of the way.

How To Make Welding Hose And

IN BRIEF: Pinches, blows, sharp edges are harder on welding hose and cable than wear, abrasion, or heat. Here's how to avoid this damage.

WHEREVER METAL is worked, you'll find anywhere from 200 feet to 2 miles of hose and cables. They carry the welding and cutting gases and currents to feed arcs and flames.

The prices you pay for hose and cable ain't hay. For example: 2/0 cable, the biggest seller, in one rubber covering, costs from 74c to 54c a foot depending on how much you buy. If you want more resistance to water, oil, ozone, abrasion, and heat, you'll have to pay several cents more a foot for neoprene cable.

Hose is expensive too. The commonest size, ¼-inch, comes in 2-braid, single and double hose. You'll pay about $4.15 if you buy a 12½-foot length of 2-braid single hose complete with connections. Fifty feet of the same hose will cost about $12.60; bale lots (500 feet and over), 21c a foot.

It boils down to this: Right now your plant has an investment of $200 to $10,000 in cable and hose. How long it lasts depends on how you care for it.

Some plants get mighty poor service from hose and cable; and it doesn't take a bookkeeper to learn the reason. A short walk through the welding department usually suffices: cables are entwined like a jungle growth, strung across aisles in the path of trucks, pinched under piles of steel, snagged under pallets and drums. Companies that put up with hose and cable jungles are usually complacent about their high production costs, waste, and accidents. Ever try to negotiate a hose and cable jungle? It's good for the waist, but it's tiring, and it's hazardous.

The incongruous part: hose and cable jungles usually take root at the beginning of a shift, don't get cleared until the whistle blows.

Something can be done about hose and cable jungles. They can be uprooted. All it takes are hose and cable reels, devices that pay out the right lengths of hose and cable, pull them in when the job is done. The only thing to remember about cable reels: You can unreel as much or as little d.c. welding cable as you like, but you must pull a.c. cable all the way out to avoid losing current.

Hose and cable reels are either spring operated (automatic) or hand operated (crank and chain drive) for welding and cutting. Reels have other uses too: cleaning, clamping, and spraying.

A typical cable reel holds 200 feet of 2/0 single

PORTABLE MOUNT for hose and cable reels adds value to a traveling welding or cutting rig; it shortens setup and cleanup time.

Cable Last Longer

cable, operates at 300 amps capacity, and tolerates a 50-percent temporary overload. Electrical connection is made through copper, and copper-graphite brushes. There are also models for shorter cables, dual jobs to handle long and short cables on the same mount. A typical hose reel holds up to 150 feet of single or double ¼-inch hose.

Reels will prevent hose and cable jungles from engulfing your plant, clogging aisles and work areas. They improve efficiency, practically eliminate tripping hazards, and add several lives to hose and cable.

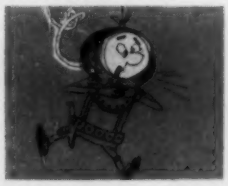
The operator is ready to trim a machine base assembly so another part will fit in place. A fitter, two other operators, and an inspector wait. Cutting will take but a minute, once the torch is there. Is it? No, it's across the bay, the hose is cleverly (or diabolically) threaded in and out of welding cable, around knife-edged steel stock. A little tug and we'll have it, thinks the operator. Wrong. It takes a tensile pull that saws the hose across the sharp steel, scatters stock, knots cable and hose, and leaves the operator trembling. Odds are, the part won't fit after cutting.

Now let's do it right. Operator goes to column-mounted hose reel, walks away with as much hose as he needs, cuts relaxed and true, tugs the hose and it retracts on the reel, safe. • •

8 SURE WAYS TO KILL INDUSTRIAL HOSE

Some people in industry murder or maim their hose, and wonder why it doesn't do the job or last as long as it should. The Dayton Industrial Products Company, Melrose Park, Ill., who make hose and fittings, investigated. They found eight proven ways to commit this crime.

1 SELECT THE WRONG HOSE FOR THE JOB—This way you won't have to use it very long because chances are it—or you—won't last long.



2 BEND THE HOSE SHARPLY TO MAKE IT LOOSE. This does a lot to destroy the reinforcement member and makes the hose easier to handle. Bending it at right angles will help, too. Don't let leaks and blowouts rattle you, you can always buy more hose.

3 YANK AND JERK THE HOSE, especially if it's hung up on a piece of machinery or is kinked. You can flatten it by driving over it, too. This will make it pliable, and may air condition it.

4 EXCEED THE RECOMMENDED WORKING PRESSURE. Sure, you can always push more through the hose. (But look out!)

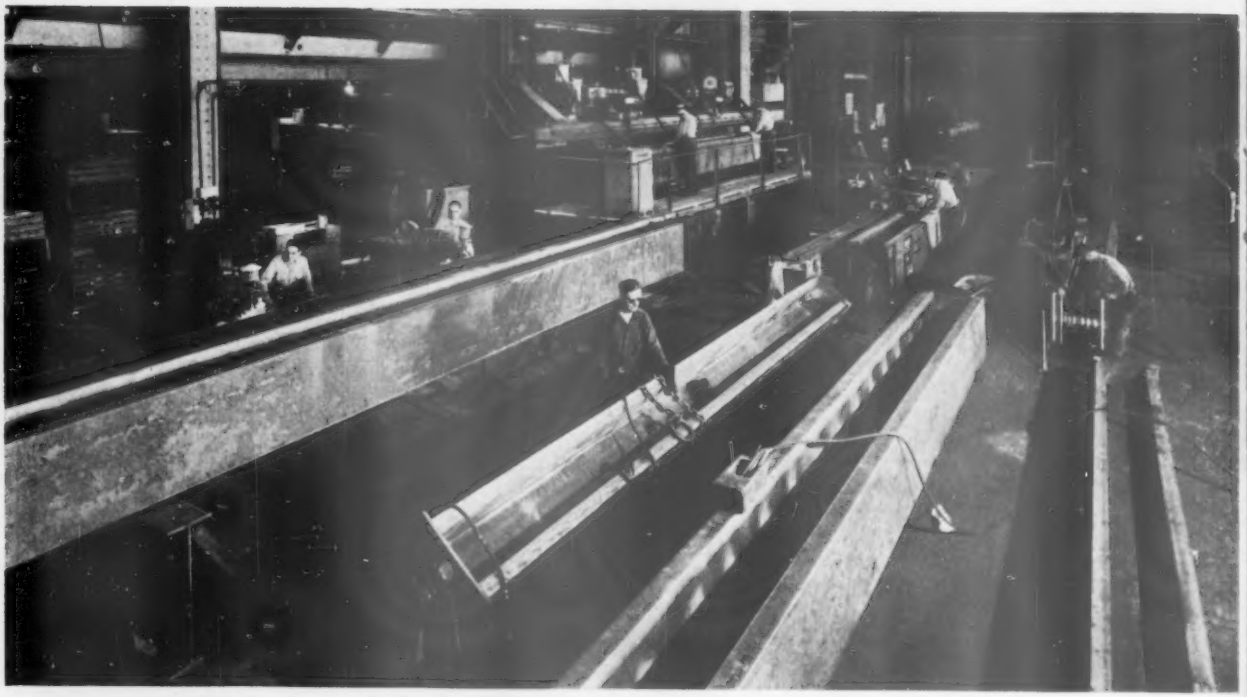
5 DRAG THE HOSE EVERYWHERE, don't bother to help it over rough surfaces and sharp rocks. Glass, dirt and grime will put your hose in shape.

6 STICK THE FREE ENDS IN DIRT TO STOP THE FLOW, and forget to check and clean the fittings. It'll help if you douse the couplings in oil and grease. It's not necessary to wash them in soap and water as the manufacturer says. (Not much, it isn't.)

7 DON'T CLEAN THE HOSE after it's been used. If it gets clogged, insert sticks and sharp objects inside to clean out the debris. If the hose protests, beat it with a sledge hammer. This is guaranteed to loosen up the clogged areas.

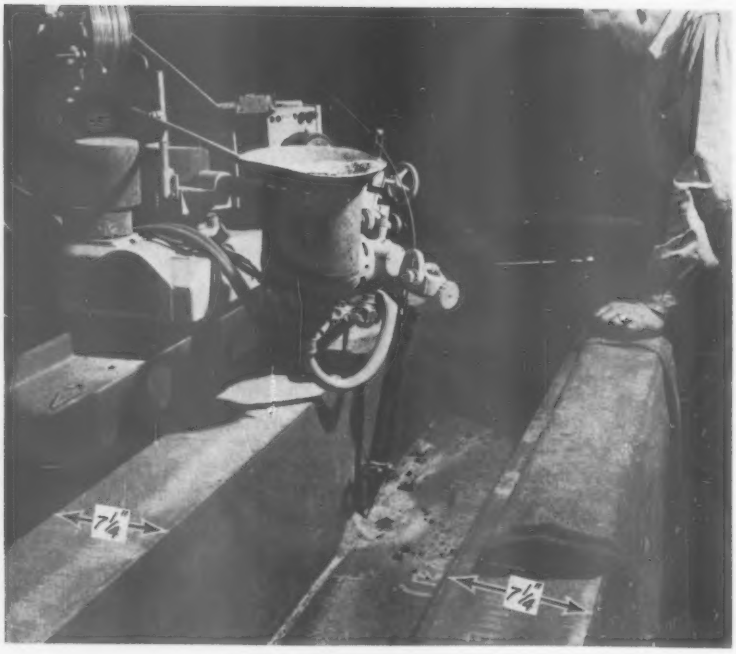
8 STORAGE IS NO REAL PROBLEM, just leave it. Don't bother about reels or racks, or the sun, acid or the elements. Hang it on a nail or hook. These grab the hose and hold it firmly.

Canada Welds Largest Solid-Section



WELDED COLUMNS for the C.I.L. House represent the largest concentration of heavy welded fabrications in Dominion Bridge's history.

HEAVY STEEL SLABS are used to build-up solid section H-columns. Slabs for flanges are 7¼-inches thick; slabs for web plates are 5-inches.



Building Columns

IN BRIEF: Welded columns in 430-foot building replace built-up, riveted shapes.

THE BIGGEST AND HEAVIEST solid-section columns ever built in Canada!

Dominion Bridge now is making them for the new 32-story, 430-foot C.I.L. House (Canadian Industries, Ltd.) in Montreal. This will be the tallest rigid frame building in the Commonwealth.

C.I.L. House is one of three skyscrapers Dominion Bridge is building in downtown Montreal. The others are the 42-story Place Ville Marie Cruciform office building and the 45-story Canadian Bank of Commerce. Each exceeds the C.I.L. House in steel tonnage —but they are riveted. C.I.L. House is almost entirely welded. High-strength bolts are used for only a few of the secondary members of the structure frame.

DESIGN BACKGROUND IS UNUSUAL

The design and fabrication of these extra-heavy H-section columns departs drastically from conventional methods. Columns for most building this high are usually built up by riveting mill-rolled shapes, such as plates, angles, or beams. This laminated construction is not suited to welded fabrication.

The C.I.L. columns are made of slabs welded together. Their cross-section resembles a mill-rolled WF (wide flange) column.

Flange slabs range up to 28 by 7¼ inches; webs up to 16½ by 5 inches. Some columns weigh as much as 2,000 lb. per lineal foot. This is over four times heavier than the largest WF section listed in steelmill shape catalogs. The building has 26 columns as each level. Each level is 2-stories high. Lengths vary from 22 feet to 34¼ inches.

Columns are made on a production line.

Flame cutting prepares the edges for welding. Slabs are then assembled and tacked in a special jig. Thirty-five-ton jacks clamp slabs together for good fit-up. Welding is done station-by-station. Columns are moved from manual arc welding to groove, to fillet welding. Groove welding gives high strength welds where floor loads will be transmitted into the columns.

Six or eight submerged arc welders are used. They work in pairs on each column. At each station, columns are mounted on trunnion stands. Here, columns are rotated and tilted to the welding angle.

The welding operators preheat slabs (200°F to 400°F) according to thickness and carbon content. Final step is fitting and welding connection plates. This is done manually and with preheating.

Welds on plates thicker than 1 inch are inspected by magnetic particle techniques. This is supplemented occasionally by ultrasonic testing. • •

NEW Complete... Welding Facilities

FOR TOUGH WELDING PROBLEMS

Rosemount Engineering Company announces the installation of a 36" chamber Electron Beam Welder in its Welding Department. REC's certified welding facilities include:

- Electron Beam Welding—from .003" foil to .500" plate —including exotic metals such as beryllium, molybdenum, tungsten and zirconium
- Tungsten Inert Gas Welding
- Metal Inert Gas Welding
- Aircomatic Gun—permits rapid deposits of wire for distortion control
- Stake Seamer—for controlled arc penetration and accurate positioning of parts

WELDING SERVICE AVAILABLE—REC's welding engineers provide consultation and establish welding procedures for difficult problems on an R and D basis. REC's welding facilities are available for production work on an hourly or piece basis. Write, wire or call if we can be of service on jobs requiring broad R and D or production experience.

REC

ROSEMOUNT ENGINEERING COMPANY

4900 West 78th Street • Minneapolis 24, Minnesota

For More Information Circle No. 59 on Reader Service Card.

50-TON POSITIONER makes possible downhand welding on fabricated hydraulic turbine runner.

Why Have Fabricated Turbine Runners Replaced One-Piece Castings?

by **CLAYTON R. FROUNFELKER, JR.,** *Hydraulic Department, Allis-Chalmers Mfg. Co.*

IN BRIEF: Strong, defect-free, and cheaper, fabricated runners are made by welding together smaller castings and steel plates.

HUGE WATER TURBINE WHEELS, called hydraulic runners, are being fabricated these days, not cast in one piece like they used to be. The reason: you get a better, cheaper runner. This means a lot in a turbine, because the runner is one of its most important parts.

DESIGN CONSIDERATIONS

A fabricated runner has curved cast steel buckets welded to a cast top plate (crown) and to a steel lower ring (band). The runner has to be strong because it is highly stressed and, sometimes, vibrated by the flowing water.

A fabricated runner is better than a 1-piece casting: The parts are smaller, easier to get; more foundries can cast them. The dimensions of small castings are easier to control and you get fewer defects.

One of the most highly stressed places on a runner is where the buckets join the crown. Runners cast in one piece often have defects there, defects which must be repaired. Welded runners are less apt to be defective because the operator controls the quality as he layers in the weld metal.

FABRICATING METHODS

Because the parts are more uniform, it's easier to balance the welded runners. We machine the underside of the crown and the inside of the band. We weigh each bucket and place it where it will help balance the runner.

We overlay the lower part of buckets on some runners with stainless steel or weld a stainless steel insert to the bucket to resist erosion. It's much easier to do this work before the buckets are welded in place. In a 1-piece runner overlaying is very difficult.

We used the most up-to-date fabricating methods on two runners for 63,500 hp turbines for the Fort Peck Dam. The smooth machined bands and crowns offered the least resistance to water flow. The runners were big: About 14 feet across, weighed 74,000 lb.

Crowns and buckets were cast to Federal Specification QQ-S-68 lb. This is a weldable, annealed mild steel. The bands are weldments of normalized A201-54T steel plate. Runner parts vary in thickness from 11/16 inches to 4¼ inches. We used double-J joints

continued on page 50

TO BE SURE . . . YOU ARE GETTING A LONGER-LASTING STEEL

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HOT ROLLED PLATES

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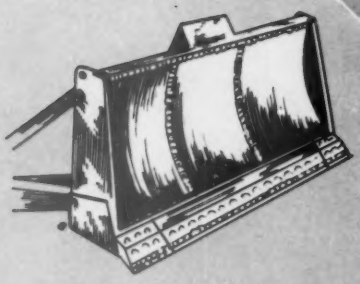

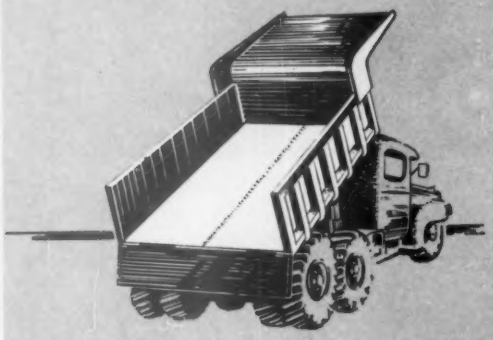

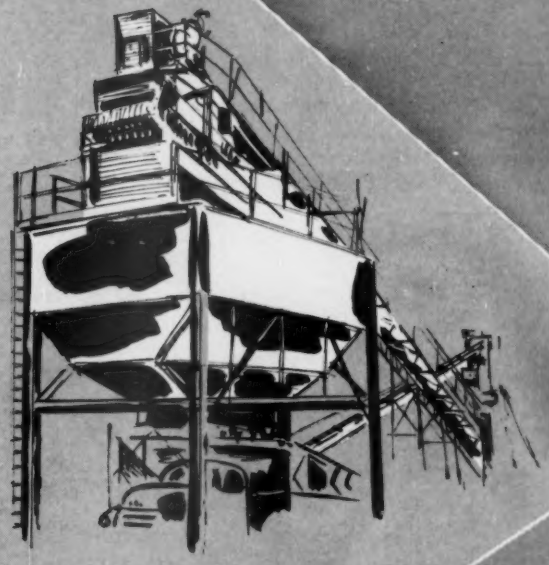

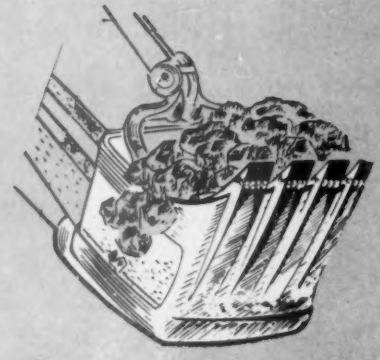

- Workhardens to a high degree under impact and heavy abrasion.
- Polishes to a smooth finish, minimizing friction-wear.
- Highest tensile strength . . . tough, too!
- Costs less than new parts; cuts down time; reduces maintenance costs.

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STULZ-SICKLES CO.

• Elizabeth, New Jersey

For More Information Circle No. 66 on Reader Service Card.

TURBINE RUNNERS *continued from page 48*

to get full-depth penetration and did our welding downhand. We welded the grooves with 3/16- and ¼-inch E7018 low hydrogen electrodes and overlayed with E-347-16 stainless steel electrodes.

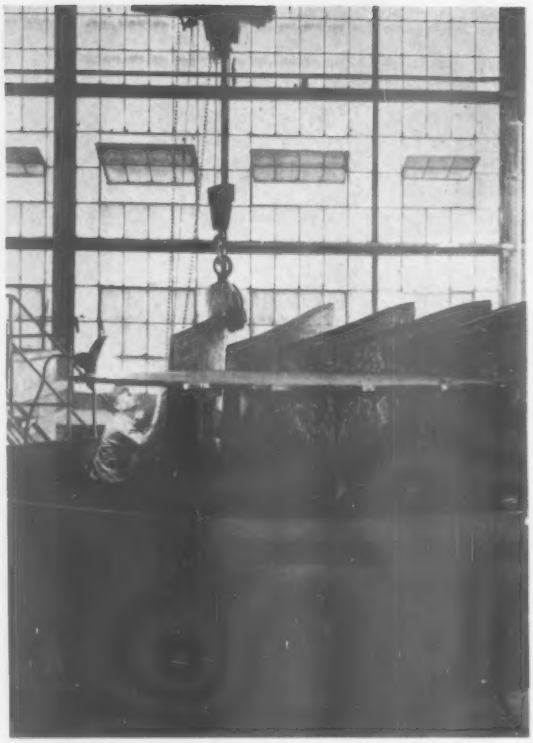
WELDING TECHNIQUES

Our gigantic welding positioner made it possible to weld downhand for faster, better welding. We magnafluxed our welds frequently. We stress-relieved twice: first when the runner was half finished, again when welding was finished. It relieves locked-up stresses and limits distortion.

Here's how we fabricated the runners.

1. Machine the underside of the crown.
2. Roll and weld the band and machine it inside.
3. Overlay the bucket bottoms with stainless steel.
4. Set the band on a face plate and set up the star-shaped fixture to locate the buckets.
5. Tack-weld temporary braces between buckets to hold them in place for welding.
6. Trim buckets at crown end and scarf to a double J welding point.
7. Fit the crown on the buckets.
8. Preheat to 200°F and skip weld. This avoids most distortion and cracking.
9. Stress relieve, grind fillets, remove braces.
10. Finish machine and balance.

We are building seven more turbines, each with twice the horsepower the Fort Peck turbines have. The runners for these turbines are being built in the same way as the Fort Peck runners. • •



STAR-SHAPED FIXTURE helps position runner in proper relation to lower ring (band). Welded braces maintain discharge openings.

FREE...for you!

Tips of the Trade from Blackhawk

Send today for your free copy of "Hydraulic Tool Ideas" — Blackhawk's colorful new how-to-do-it booklet for welding and fabricating. It's jam-packed with time-saving, cost-cutting ideas you can use right now! Ideas like these...

- What to do when a production run is too small for press brake tooling, too big for "bellows and anvil" methods;
- How to solve that ever-present problem of heat distortion after welding;
- How to fitup heavy metal components for tacking;
- How to design your own low-cost fixtures for welding complex assemblies.

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RUSH my free copy of "Hydraulic Tool Ideas"!

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SPOT WELDING MINIATURIZED PARTS

continued from page 35

of care is taken to get strong, correctly placed welds at every step of the tedious assembly.

PLACING FILAMENTS IS CRUCIAL

The most crucial operation in the gun's development is placing the two filaments. Each filament is similar to that of a common light bulb. It is a 0.003-inch tungsten wire in a coil $\frac{3}{8}$ inch long and $\frac{1}{8}$ inch wide. Both leads terminate at the same end. The filament is insulated with aluminum oxide. The two filaments are attached to stainless steel wire imbedded in the base. This is done by direct welding or by using a nickel tab to bridge any gap between the filament and the stainless wire. Fortunately, the oxide on the filament does not prevent making a good weld.

Each time the tube is switched on and off, both filaments are heated to 2,000°K and then cooled. Their expansion and contraction makes the filaments the most overworked parts in the gun. A good strong weld is needed, yet the weld must not weaken the filament itself. Blade-shaped electrodes are used to make these important connections.

Several small wire loops (getters that remove any gas from the tube while it is operating) are then welded to the main frame, along with a number of stainless spring clips to position the gun against the tube wall. This completes the assembly of the gun. Then comes a thorough inspection. • •

Get the lion's share of meaty facts out of this issue of WELDING DESIGN & FABRICATION before you pass it along to the next reader. Leaf through once more: If you want full details on any item, the Reader Service Card will bring them to you quickly. No postage needed.

WELD FLAWLESSLY and PERFECTLY because with TEC . . .

- **YOU SAVE on GAS!:** Engineered to expand gas volume and control turbulence for a uniform gas flow.
- **YOU SAVE in PARTS!:** No stock of spare parts necessary. Unit construction in all models.
- **YOU SAVE in TIME!:** See what you weld. Nozzles for every situation.
- **YOU SAVE in LABOR!:** Less weight . . . less fatigue . . . less down time.

TEC — MANUFACTURERS OF VISUWELD EQUIPMENT
TEC TORCH CO., INC.
CARLSTADT, N. J.

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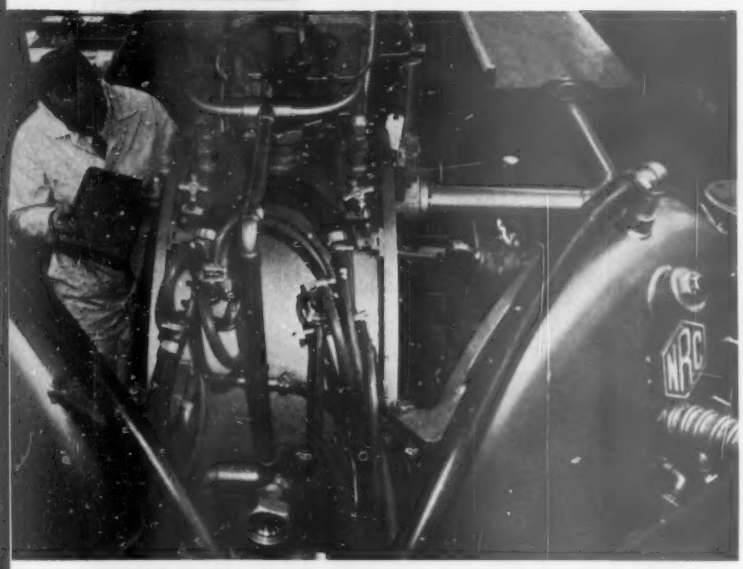


BOTH FURNACE DOORS swing open for easy loading and maintenance. Tantalum heating elements (A) surround work area and in turn are surrounded by radiation shields (B). Work pieces are positioned on tungsten pins (C).

Why Martin Brazes In A Vacuum Furnace

by **MEL SCHWARTZ,** *senior manufacturing engineer, Martin Company's Baltimore Division*

IN BRIEF: Martin also uses this unique cold-wall high-temperature vacuum furnace to heat treat, anneal, and sinter.

WE'RE DIFFERENT. We have the only cold-wall, high temperature, vacuum furnace of its kind in the United States. (The heating elements of a cold-wall furnace are on the inside of the chamber. The heat is reflected inward, so that it isn't absorbed by the walls.)

In this resistance furnace we can braze, sinter, heat treat, and anneal. We can get as high as 4,500°F with a 0.1 micron pressure. The only non-metallic refractories in our furnace—made by National Research Equipment Corp.—are the thermocouples and power feed. And even they are shielded and remain cool. The chamber, or shell, contains the one cubic foot of heater space. This space is surrounded by heating elements and shields.

We can use the furnace at 4,000°F for one hour, or 4,500°F, for shorter periods. However, at 4,500°F, recrystallization and grain growth shorten the life of the elements. They take 16-man-hours to replace. We expect heating elements to last 75 hours at 4,000°F and 250 at 3,500°F.

FURNACE DESIGN

The chamber opens on either side. This simplifies loading and maintenance. The stainless steel inner chamber is water-jacketed. The shell has pumping and observation ports.

The heating elements are not the conventional rod, wire, or ribbon. The refractory insulation on these will not last at 4,000°F. Instead, our elements are corrugated strips of tantalum, located on all faces of the heater. Water-cooled copper posts support the strips. We operate these elements at low voltage to prevent their arcing with other furnace parts. Heat hardly distorts the tantalum elements because the corrugations absorb most of the distortion. They lose less heat through radiation than rod or ribbon elements because the reflected heat can't pass between the gaps.

Heat loss is controlled by the metal shields. These are arranged in packs of six—three tantalum and three molybdenum shields. The small internal parts have low specific heats so they heat and cool efficiently. We also use inert gas to speed heating and cooling.

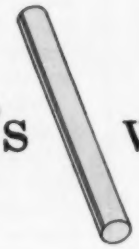
We divide our 200 KW power input between the six sides of the heater. Saturable core reactors control the power to each side. The DC control signal comes from a magnetic amplifier system. A strip-chart records the signals.

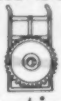
Our operator can maintain a constant power setting on the reactor power supply so the furnace temperature remains steady. The furnace will not overheat because the temperature depends directly on power

Continued on page 54

Anaconda Memo to Management

This is a penny's worth of bronze



It's a piece of Anaconda welding rod that could be worth its weight in gold to you. It might save you a big capital investment or important production time by salvaging equipment that seems beyond repair. Take the experience of Jessop Steel Co., for example. A while back their production stopped dead in its tracks when the 60-ton semisteel base of a big forging hammer fractured. A replacement base? Of course—in nine months. Jessop called specialists in repairing heavy machinery. The base was repaired by braze welding in a week —at 20% of replacement cost. About a ton of Tobin Bronze®-481 rod was used. But sometimes a few ounces can make equally significant savings in building up worn surfaces or repairing a broken part that has immobilized  a big machine. *And don't overlook braze welding in production.* It's a practical way to get flexible, low-cost production assembly of tubular and sheet steel products —like furniture and appliances. American Motors uses it to add strength, prevent squeaks, leaks, and rattles in unit construction of the Rambler's body, supplementing electric welding in some 30 areas. Anaconda-997 (Low Fuming) Bronze Rod has proved to be the best welding rod for these production uses.

6080 Rev L

We'd be glad to send you (or anyone else in your company) a copy of Publication B-13 which gives detailed and practical information on Anaconda Welding Rods in repair and production jobs. If you have a special problem, the services of an Anaconda specialist are at your disposal. Write: Anaconda American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

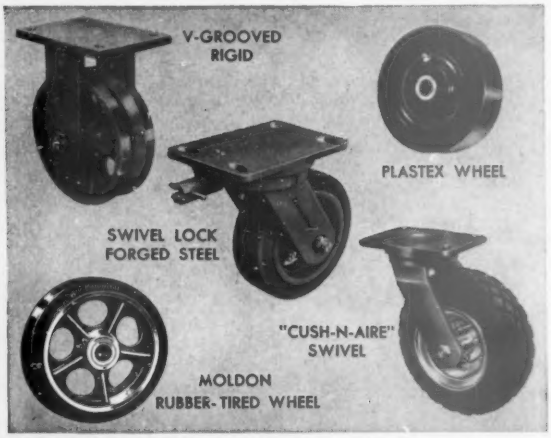
ANACONDA®

WELDING RODS

Anaconda American Brass Company

For More Information Circle No. 13 on Reader Service Card.

For More Information Circle No. 35 on Reader Service Card.



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VACUUM BRAZING *continued from page 52*

input. Manual adjustment for each DC winding of the reactor balances the initial phase loads. We think the advantage of this control is that it doesn't fail. We use a 10-inch vacuum diffusion pump to develop pressures in the range of 10^{-6} mm of mercury. Water flow switches cut off power if the water supply fails.

Measuring temperatures as high as 4,500°F is difficult. Optical pyrometers didn't work because condensation fogged the sight glass. Cleaning solutions didn't help.

Tungsten-molybdenum and tungsten-iridium thermocouples did not work because they became brittle. We found finally these advantages in tungsten-rhenium thermocouples:

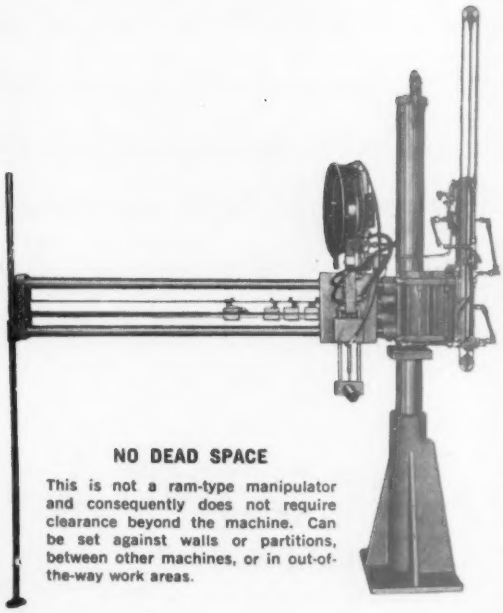
- High thermoelectric potential
- High thermoelectric power
- High melting points
- Rhenium remains ductile after heating

At first, we insulated the thermocouple with thoria. But, later tests showed it becomes extremely conductive at 2,800°F. We are now testing a sheathed thermocouple. The sheathing is tantalum and the insulation is beryllium oxide.

What are we doing with our furnace? We're doing metallurgical research on welds, vacuum annealing, brazing, and sintering of exotic metals.

Before long, our furnace should pay for itself many times over. • •

TRI-CITY AUTOMATIC WELDING MANIPULATOR



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This is not a ram-type manipulator and consequently does not require clearance beyond the machine. Can be set against walls or partitions, between other machines, or in out-of-the-way work areas.

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Designed specifically for use with turning fixtures or work-holding positioners, the Tri-City Manipulator is ideal for subassemblies, production runs and special jobs.

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AIR-ON-OIL DRIVE
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Write for descriptive literature

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To learn how an Aardvark licks termites... call in a *ZOOLOGIST*

(specialist on animals)

A native of Africa, the AARDVARK is a large, nocturnal, burrowing mammal subsisting largely on termites and has a long extensile tongue for gathering them. He has heavy claws for ripping open rotten logs to find more termites.

To learn how to lick welding problems... call in *LINCOLN*

(specialists in arc welding)

A VIRGINIA manufacturer of underground gasoline storage tanks needed to cut his welding costs . . . his highly competitive industry being plagued with low profits.

Although they were already using the LINCOLN automatic submerged arc process, the LINCOLN Field Engineer was able to show this company how to eliminate 25% of their welding labor. He switched them to the new LINCOLN vapor shielded INNERSHIELD process.

Now the 4000-gallon tanks, fabricated from ¼" steel, are welded at 90 inches per minute . . . with three men doing the job formerly done by four. Thus, reduced labor costs have substantially increased the profit margin.

In addition, when this manufacturer licks a rolling and fit-up bottleneck, the three weldors will be able to almost double their present output with no additional help.

That's why we say it's a good idea to do business with LINCOLN where arc welding is a specialty and cost reduction comes to you as a "plus" at no charge.

THE LINCOLN ELECTRIC COMPANY
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LINCOLN WELDERS

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This answer may be as near as the nearest of over 1000 All-State distributors here and abroad. Or just write or phone (WHite Plains 8-4646) our Technical Department and Laboratories, White Plains, N. Y. A few minutes and a few pennies might save you thousands of dollars.

To help you know the line and select the alloy and flux best suited for each job, All-State publishes a 56-page INSTRUCTION MANUAL, free to interested users. Also, a special ALUMINUM MANUAL containing 36 pages of data on aluminum alloys and how to join them. If you work with aluminum, ask for a copy.

To serve you, All-State maintains 3 factories, 4 warehouses (White Plains, N. Y.—St. Louis, Missouri—South Gate, California—Toronto, Ontario, Canada) and a central Technical Department and Laboratory at headquarters.

All-State ALL-STATE WELDING ALLOYS CO., INC.
WHITE PLAINS, NEW YORK

Circle No. 11 on Reader Service Card.

REFERENCE DATA *catalogs, handbooks, manuals*

NEW HANGER CARD from Punch-Lok Company explains the cost of compressed air leaks. Form F-255-A compares area of leak by diameter in fractions of inch with air loss by cubic feet per month at 75 psi and with dollar loss by cost of waste per month at $0.12 per 1,000 cu. ft.

Circle No. 300 on Reader Service Card

TWO WALL CHARTS produced by Smith Welding Equipment Corp. compare the distinctive traits of the Oxy-LP gas flame with the oxy-acetylene flame. Each chart has four full color illustrations of the welding flame and five of the cutting flame. Charts are 11 by 17 inches and fold to 8½ by 11 inches.

Circle No. 301 on Reader Service Card

CHANGING ELECTRODES in seconds is explained in a catalog from P. R. Mallory & Co., Inc. Described and illustrated is the company's Nu-Twist system which permits easy insertion and removal of resistance welding electrodes and eliminates electrode-to-holder seizures.

Circle No. 302 on Reader Service Card

ROTARY BENDERS for forming tube, pipe, bars, structural shapes and channels from steel, stainless, copper, brass, and aluminum are described in a new catalog available from Wallace Supply Mfg. Co. These benders range from manual to fully automatic and will bend from ¼" O.D. tube to 17" O.D. pipe.

Circle No. 303 on Reader Service Card

BRANCH CONNECTION FITTINGS for fast, durable, economical pipe branches are described and illustrated in Bulletin TF-1-59R from H. K. Porter Company, Inc. The bulletin gives price comparisons, design data, and lists typical installations for new TeeLet and Fishmouth fittings.

Circle No. 304 on Reader Service Card

HEAT TRANSFER AND PROCESS EQUIPMENT built by Niagara Weldments Inc., is described and illustrated in a 4-page bulletin. The bulletin (No. 51) lists standard products—water heaters and hot water converters—as well as specially-engineered equipment—coolers, condensers, heat exchangers, and pressure vessels.

Circle No. 305 on Reader Service Card

INSTRUCTION MANUAL and catalog with 56-pages of instructions for welding, brazing, and soldering is offered by All-State Welding Alloys Co., Inc. The 4 by 7 inch manual gives physical properties, detailed application instructions, and techniques for using the company's complete line of products for joining all commercial metals.

Circle No. 306 on Reader Service Card

CARBON DIOXIDE and how it is used in the welding industry is the subject of Form ADPC 26A issued by the Pure Carbonic Co. The illustrated 8-page brochure explains in detail the characteristics and advantages of the various welding processes in which carbon dioxide is used as a shielding gas.

Circle No. 307 on Reader Service Card

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

A NEW SELECTOR MANUAL covering basic types and styles of work and welding gloves is available from the Glove Division of Riegel Textile Corp. The guide contains information on basic cuts, cuff styles, and other specification details.

Circle No. 308 on Reader Service Card.

METAL FINISHING with air tools is the subject of catalog G-60 from Master Power Corporation. The catalog describes and illustrates the company's complete line of air power tools and attachments for weld grinding and finishing.

Circle No. 309 on Reader Service Card.

A NEW GAMMA radiography tool is introduced by Radionics, Inc. in a catalog sheet. The sheet includes specifications, safety precautions, and operating instructions for the new Model 60-1,000 Gammatron.

Circle No. 310 on Reader Service Card.

AN ELECTRODE WALL CHART gives description, number, color code, mechanical properties, size, current range, procedure and application information on a complete line of welding electrodes available from Hobart Brothers Company. The chart is 23 by 35 inches.

Circle No. 311 on Reader Service Card.

C-CLAMPS for light industrial applications are featured in a catalog from Wilton Tool Mfg. Co., Inc. Described and illustrated are five different size units in the new "200" Series.

Circle No. 312 on Reader Service Card.

PIPE WELDING CLAMPS are the subject of an illustrated brochure available from the Jewel Manufacturing Co. Prices and full descriptions are included for pipe, elbow, flange, and angle clamps.

Circle No. 313 on Reader Service Card.

AN AUTOMATIC MACHINE for flame cutting structural members is illustrated in a folder offered by Steffan Manufacturing Corporation.

Circle No. 314 on Reader Service Card.

Circle No. 74 on Reader Service Card.

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Headquarters for Resistance Welding Supplies

R.W.M.A. Classes of alloys in castings, forgings and bar stock; copper tungsten alloys

Standard electrodes; special electrodes and fixtures designed and built

All types of straight and offset holders

Welder wheels in all alloys and sizes

Tip dressers, reamers and contour dressers

Adjust-A-Pressure holders (above, left) used with Adjust-A-Angle adapters solve many welding problems; change from one electrode spacing to another — a matter of minutes — with the same set-up.

S-M-S CORPORATION

2254 COLE AVENUE • BIRMINGHAM, MICHIGAN

For More Information Circle No. 61 on Reader Service Card.

Circle No. 60 on Reader Service Card.

Remove Welding Fumes at the Source... with RUEMELIN FUME COLLECTOR

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed.

Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle.

WRITE FOR DETAILED INFORMATION

RUEMELIN MFG. CO.

3932 N. PALMER STREET • MILWAUKEE 12, WIS., U.S.A.

Mfrs. & Engineers • Sand Blast & Dust Collecting Equipment

USEFUL LITERATURE *continued*

RUBBERIZED ABRASIVES and their uses in industry is the subject of a 22-page manual from Cratex Manufacturing Co., Inc. Typical applications are given and recommended operating speeds are listed.

Circle No. 315 on Reader Service Card.

PORTABLE SAND BLASTERS are featured in a 2-page color brochure from ALC Company. It outlines complete specifications for the company's Sandy Jet sand blaster.

Circle No. 316 on Reader Service Card.

WELDING FIXTURES and positioners made by Leonard Precision Products Co. are described and illustrated in a 4-page brochure. Information is given on a variety of special machines.

Circle No. 317 on Reader Service Card.

MANUAL AUTOMATION with low cost templates is explained in an illustrated brochure from Wiedemann Machine Co. The brochure explains how this production system is used for high speed hole positioning and piercing (60 to 100 holes per hour) on the company's RA-41P turret punch press.

Circle No. 318 on Reader Service Card.

A NEW B-BEAM CLIP developed by the Caddy Fastener Division of Erico Products, Inc., is featured in an illustrated catalog sheet. The clip is designed for telephone use to replace present universal clamps and/or support brackets.

Circle No. 319 on Reader Service Card.

X-RAY LITERATURE LIST from Philips Electronic Instruments lists 376 papers on X-ray analysis subjects published over the last 30 years. Authors, publication names and dates, and article titles are given.

Circle No. 320 on Reader Service Card.

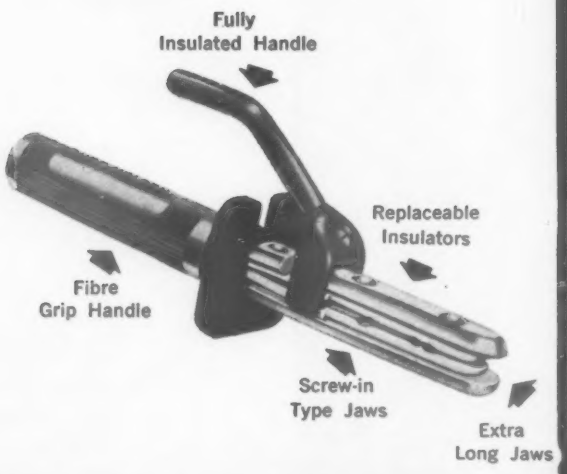
A DOUBLE ARC, double spindle roller and idler rebuilder developed by Victor Equipment Co. is featured in Form VH-2. Twelve

For 27 Years Preferred By Welders

THE DURO "STANDARD"

- All Parts quickly replaced with a screwdriver
- Screw-in type jaws — No tools required
- Insulated Handle and Guard — Protects operator
- Rugged Fibre Handle — Lasts longer
- Cool Operation — Cool Handling

Featuring "Long Jaw design" for reaching those "hard to get at places".



DURO ENGINEERING COMPANY

31 OREGON AVE. · HAMDEN, CONN.

For More Information Circle No. 26 on Reader Service Card.

features of the machine are explained in detail; specifications are given.

Circle No. 321 on Reader Service Card.

"THE LIQUID STORY" published by Air Reduction Sales Co. covers principles and techniques of handling, storing, and converting liquefied oxygen, nitrogen, and argon. Schematic drawings help clarify Form ADC 935.

Circle No. 322 on Reader Service Card.

STUD WELDING EQUIPMENT manufactured by Shielded Stud Welding Co. is the subject of a 4-page illustrated brochure. Featured is the company's Model R stud welding unit that includes gun, controls, and accessories.

Circle No. 323 on Reader Service Card.

WELDING FACILITIES for tough welding problems are featured in literature from Rosemount Engineering Co. Described and illustrated is company's complete line of equipment for custom welding. Featured is a 36" chamber electron beam welder.

Circle No. 59 on Reader Service Card.

COMPLETE ELECTRODE DATA is given in a 20-page booklet from National Cylinder Gas Division of Chemetron Corp. Booklet NH-504 gives information on electrode specifications, chemical requirements, and methods of estimating electrode consumption.

Circle No. 325 on Reader Service Card.

WELDING STAINLESS is covered in a new 6-page reference guide issued by McKay Company. Featured in the guide is a valuable and handy chart that gives chemical and physical specifications of McKay's stainless steel electrodes. Specific case history studies are included.

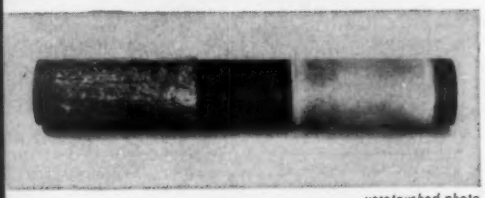
Circle No. 326 on Reader Service Card.

A REVOLUTIONARY fusion process for filling metal cavities, undercuts, scratches and imperfections is the subject of literature issued by the Mid-States Welder Mfg. Co. The company's new "Dot Welding Process" is illustrated and described in detail.

Circle No. 327 on Reader Service Card.

HARD FACING TIME CUT FROM 4 HOURS TO 25 MINUTES

The two end sections of this shaft have been built up with AMS 4775. Section at left applied by welding – time 4 hours; section at right by flame spraying – time 24 minutes, 45 seconds.



unretouched photo

QUESTION: And which end would you prefer to grind finish?

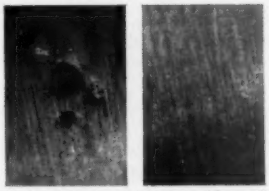
Here's the whole story. We took a 15" length of 2.5" mild steel shafting and undercut two 5" sections .050" on the radius. We then sent the shaft to a nationally-known job shop with instructions to apply AMS 4775 on the left-hand section, sufficient to finish at 2.5". Weight of welded-on alloy was 17 9/16 ounces – time spent by one of their top men – 4 hours (including preparation).

Then we blasted the second section with steel grit and flame sprayed it with AMS 4775 in powder form (ThermoSpray Powder 15E). The coating was then torch-fused. Weight of deposited alloy – 11 5/16 ounces; surface preparation, set-up and pre-heat – 12 minutes; spray time – 5.5 minutes; fusing time – 7.25 minutes.

Finish-ground shaft – welded section at left, flame sprayed section at right.

unretouched photo

We then sent the shaft out to a grinding shop with instructions to clean up at 2.500" plus. The flame-sprayed section cleaned up at 2.510" but welded section still showed pits when grinding was stopped at 2.477" (see photos below left). Rockwell of welded end Rc-61, sprayed end Rc-60.



Note pits in welded section at left. Both magnified about 50x.

These flame-sprayed coatings are solid, homogeneous; usually superior to those applied by other methods. You can apply them at high speed, with lower material and finishing costs. In addition to AMS 4775, a number of other powders – including tungsten carbides – are available for various service requirements; all may be fused–some used as sprayed for certain service requirements.

For further information on this high-speed, money-saving, hard-facing process, phone, write or wire.

Pump plunger being flame sprayed with METCO ThermoSpray Powder Gun

METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1179 Prospect Ave., Westbury, L. I., N.Y. Telephone: Edgewood 4-1200 Cable: METCO
In Great Britain: METALLIZING EQUIPMENT CO., Ltd., Chobham-near-Woking, England

METCO INC.
1179 Prospect Ave., Westbury, L. I., New York
Please send me free bulletin on hard facing.

Name _____
Title _____
Company _____
Address _____
City _____ Zone _____ State _____

For More Information Circle No. 51 on Reader Service Card.

For More Information Circle No. 7 on Reader Service Card.

ACRO WELDER MFG. CO.
MILWAUKEE
WELDING ENGINEERS
MACHINERY BUILDERS
ESTABLISHED 1936

ACRO® general purpose spot-projection-butt-seam resistance welding machines.

ACRO-ARC® special purpose production welding machinery employing automatic arc welding processes.

ACROMATIC® special purpose production welding machinery employing resistance welding processes.

ACRO-MAGNETIC® magnetic force spot, projection, and percussion welding machines.

H&M PRODUCTS FOR PROFITABLE PIPE CUTTING AND BEVELING

STD. MACHINES
FAST, accurate cutting and beveling of all sizes of pipe from 1½"-36". Simple operation . . . operator can master machine in a matter of minutes.
PAT. APPLIED FOR

"BEVEL-LAND" GRINDER
No more time consuming handwork. "BEVEL-LAND" smooths pipe cuts and accurately places the lands on bevels in a matter of seconds.
PATENT NO. 2,869,293

OUT-OF-ROUND
Insures even, accurate cuts of irregular pipe. Roller rides pipe surface . . . makes cutting easy, simple. Fits all H&M Machines.
PATENT NO. 2,643,373

SHAPE CUTTER
Accurately cuts saddles, tees, els and other irregular shapes. Lightweight, extremely portable . . . fits all H&M Machines.
PATENT APPLIED FOR

WRITE FOR CATALOG SHEETS AND PRICE LISTS ON THE COMPLETE H&M LINE.

H&M TM Reg
PIPE BEVELING MACHINE COMPANY
311 E. Third St. DI 3-0241
TULSA, OKLAHOMA

For More Information Circle No. 34 on Reader Service Card.

USEFUL LITERATURE *continued*

CENTER FINDER that makes faster pipe layouts with greater accuracy is featured in literature from Manning Mfg. Co. Described in detail is the tool's automatic spring-loaded punch.

Circle No. 76 on Reader Service Card.

SELF-STUDY COURSE in silver brazing is the subject of a bulletin available from Handy & Harman. The illustrated bulletin explains how the self-study course can be used for at-home or in-plant training.

Circle No. 329 on Reader Service Card

A POCKET SLIDE CHART which provides pertinent resistance welding data is available from Ampco Metal, Inc. The colorful 9¼" x 4" chart selects the proper electrodes for joining the commonly welded ferrous and non-ferrous alloys.

Circle No. 330 on Reader Service Card

MANIPULATOR for automatic welding is featured in catalog from Tri-City Tool & Machinery Corp. Catalog explains that the unit has no dead space: It is not a ram-type unit and does not require clearance beyond the machine.

Circle No. 69 on Reader Service Card.

A NEW DISC WHEEL and how it can be used for portable grinding jobs is explained in literature from Bay State Abrasive Products Co. Introduced is the company's new "Koolie Hat" reinforced resinoid disc-wheel.

Circle No. 332 on Reader Service Card

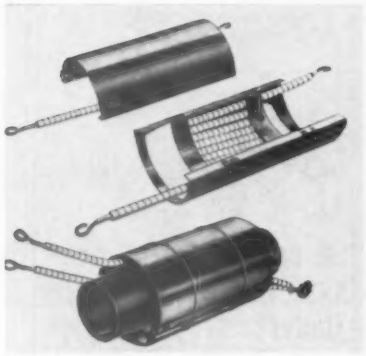
BLOWTORCHES for preheating and heat treating are featured in a catalog from Clements Mfg. Co. Portable units can be used with natural, manufactured, or L-P gas.

Circle No. 20 on Reader Service Card.

AN IMPROVED SOURCE of rectification in welding equipment application is featured in literature from Radio Receptor Co., Inc. Described and illustrated is the company's Tri-Amp rectifier that is said to have the highest surge capacity of any semiconductor.

Circle No. 57 on Reader Service Card.

NEW PRODUCTS



Clamp-On Stress Relieving

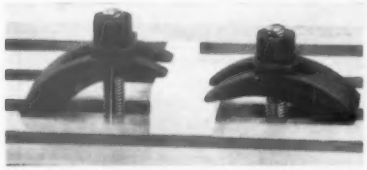
A clamp-on resistance heating unit for stress relieving welds in small diameter pipes and tubes has been developed by Electric Arc, Inc. Two units: Model NV-C and Model Class 712, are produced. Model NV-C is a low voltage, high current unit for 2- to 6-inch pipe or tube, ⅜-inch wall and less. Class 712 is for higher voltage stress relieving of pipe welds in 1- to 2¾-inch O.D.

Circle No. 200 on Reader Service Card.

Thin-Metal Testing Machine

A new machine for testing ductility of foil and thin sheet metal has been developed by the Detroit Testing Machine Company. Called Thin Sheet Metal and Foil Tester (Model TSD), the machine is designed to permit quick, accurate readings for both experimental and production work.

Circle No. 201 on Reader Service Card.



Hold-Down Clamps

The Insta-Clamp Co. manufactures a heavy-duty, forged steel clamp they call Insta-Clamp, for holding various sized work pieces to machine tool tables. Clamps come in 4- and 8-inch sizes.

Circle No. 202 on Reader Service Card.

Arc Spot Gun Power Supply

Bren Weld Corp. has announced their new Model 150 power supply for use with their Model H arc spot weld gun. The unit has 5 heat stage plugs, weighs only 41 pounds, and operates on 115 volts. It will weld 14 gage or lighter to any thickness (minimum 2 pieces, 26 gage).

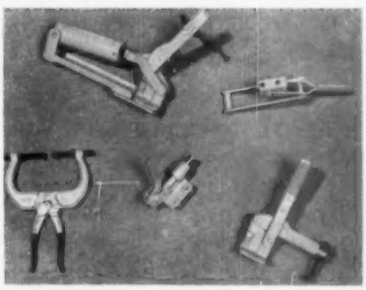
Circle No. 203 on Reader Service Card.

Solder Pastes

A new formulation for Eutec-Tin-Weld, paint-on solder paste, has been developed by Eutectic Welding Alloys Corp. The new paste combines an exact balance of alloy and flux. It gives long shelf life without metallic elements settling, flux separating, or hardening in the jar.

The paste is made in four formulations: all purpose; for stainless and nickel alloys; neutral, for electronics work; and for copper, brass, and bronze.

Circle No. 204 on Reader Service Card.



Toggle-Action Clamps

Universal Engineering Co. has introduced a line of toggle-action clamps called Uni-Klamp. A minimum force is required for locking or unlocking.

Circle No. 205 on Reader Service Card.

RUSH JOB ON FLAME CUTTING?

Phone your Airco Distributor . . .

He goes out of his way to make that special delivery

You can't make the deadline if you lack gases, equipment or supplies to do the job. So why take a chance? Call your Airco Distributor. He'll break all records to see that you get *all* that you need *when* you need it. His service and practical know how are backed up with Airco's years of welding experience.

For high production or high precision, choose from the **AIRCO** quality line of gas cutting and welding equipment — flame cutting machines—arc welding equipment and arc welders—gas-shielded arc welding process equipment — high purity and rare industrial gases — electrodes — supplies and accessories.

Call your nearby Airco Distributor. He's listed in your Classified Telephone Directory under "Welding Equipment and Supplies."

AIR REDUCTION

. . . represented by over 700 Authorized Airco Distributors from Coast to Coast

AUTHORIZED AIRCO DISTRIBUTOR

Circle No. 8 on Reader Service Card.

WELD WITH Tipaloy

YOUR Resistance Welding Electrode NEEDS Are OUR Business!

Whether it be:
TIPS:
ROD or BAR:
SEAM WELDING WHEELS:
FORGINGS:
CASTINGS:
HOLDERS:
ADAPTERS:

SPECIAL WELDING DIES or FIXTURES: TIPALOY *has them.*

BUY TIPALOY and save money!

TIPALOY can supply you with:
RWMA Class #1, Tipaloy #100
RWMA Class #2, Tipaloy #130*
RWMA Class #3, Tipaloy #200
and other RWMA classes of alloys to fit your needs.

It is unwise to pay too much, but it is worse to pay too little!

Use TIPALOY and get 30% to 100% more performance for your money than you are now getting.

BUY TIPALOY and get TIPALOY QUALITY

Send your trial order today

*TIPALOY #130 cast and processed under our patents.

FREE: Write for your copy of Tipaloy's comprehensive new catalog.

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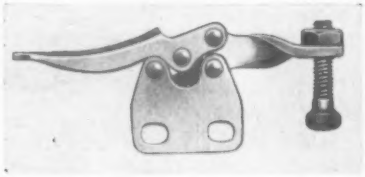
Tipaloy INC.
1435 E. MILWAUKEE AVE.
DETROIT 11, MICHIGAN

Circle No. 68 on Reader Service Card.

Push Type Welding Gun

An air-cooled push-type welding gun and wire feeder for use with gas shielded metal-arc welding has been announced by Air Reduction Sales Co. The gun, Model AH60-B, is ruggedly built for heavy duty cycle work. It has a 60° gooseneck nozzle assembly for welding in hard-to-reach places, and a lever-type trigger. The wire feeder, companion to the gun, provides up to 600 ipm wire feed speed adjustment near the work.

Circle No. 206 on Reader Service Card.



Toggle Clamps

Detroit Stamping Co. has improved its Series 105 tiny toggle clamps. New design provides a larger mounting area for more rigidity, slotted mounting holes to simplify final adjustment, and a holding strength up to 42- lbs.

Circle No. 207 on Reader Service Card.

Ignitron

Without increasing equipment dimensions, a Jumbo C size ignitron boosts power output of standard C-size welders by 50 per cent. The new tube, GL-7681, was developed by the General Electric Power Tube Division. It has a stainless steel jacket, mounting plate for detachable thermostat, flexible anode lead, and anode and cathode terminals with slotted holes for easy installation.

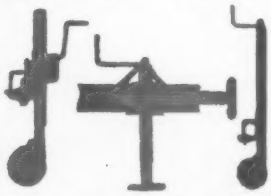
Circle No. 208 on Reader Service Card.

a constant source of business for you...

A complete line of - Axle Assemblies, Trailer Undercarriages, Farm & Trailer Jacks, Implement & Trailer Couplers, Spindle End Assemblies

BULL DOG AXLE ASSEMBLIES

BULL DOG JACKS



BULL DOG COUPLERS

A COMPLETE LINE OF COUPLERS

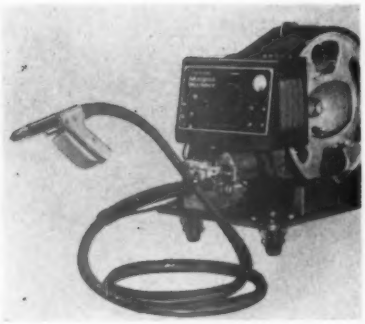
SPINDLE END ASSEMBLIES

Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts — Spindle Ends, Hubs, Wheels.

Contact our engineering department for full details on your particular application — a FREE service to you — write for Catalog 18-R

NEVER LETS GO
HAMMER BLOW TOOL CO.
WAUSAU • WISCONSIN

Circle No. 36 on Reader Service Card.



Welding Hand Guns

Three new hand guns for metal inert gas welding are being produced by Auto Arc-Weld Mfg. Co. for use with their Magna Welder. Model 3372-D (shown) is the simplest to operate; gas and wire feed start when the arc is struck. Model 3374-D has manual gas control. Model 3380-D has manually controlled gas supply and water-cooled contact copper and gas barrel.

Circle No. 209 on Reader Service Card.

Electric Cable Protection

A two-step system announced by Dearborn Chemical Co. will make electric cables arc-proof and corrosion-proof. No-Ox-Id Wrap protects cables from corrosion and No-Ox-Idized asbestos tape provides arc-proof protection after the wrap has been applied. No-Ox-Idized can also be used alone for arc-proofing neoprene- or vinyl-coated cables.

Circle No. 210 on Reader Service Card.

Natural Gas Torch

Harris Calorific Company's No. 19-S Torch with the 1390 'H' tip can be used for brazing and silver soldering.

The Harris 19-S offers three advantages over oxy-acetylene torches: lower fuel gas costs; the flame has a soaking heat effect; the finished work is clean and free of carbon deposits.

Circle No. 211 on Reader Service Card.

Metal Removal Electrode

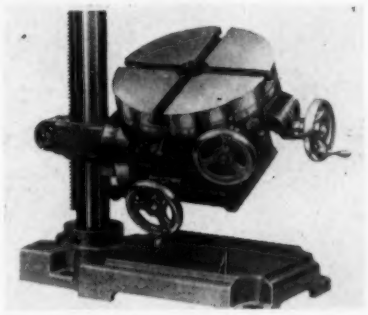
A new type of carbon electrode developed by Arcair Company eliminates spalling and splintering at high current densities. The Grade Q electrodes come in ½", ⅝" and ¾" sizes.

Circle No. 212 on Reader Service Card.

Hard-Facing Electrode

A new electrode has been developed by Stoody Company for reclaiming wearing parts subject to severe impact and abrasion. Designated Stoody 1105, the electrode has an iron powder, alloy-containing coating extruded on a mild steel core wire. Characteristics of 1105 are: fast deposition, high hardness and strength, forgeable, heat treatable, and machineable.

Circle No. 213 on Reader Service Card.



Drill Press Table

A new all-purpose drill press table which fits all popular size bench- and floor-model drill presses has been developed by Chicago Tool and Engineering Co. The Palmgren No. 500 table is quickly installed, provides two cross slide movements, 360° rotary feed, graduated tilting adjustment, and take up adjustments.

Circle No. 214 on Reader Service Card.

This metal powder spraying unit applies wear resistant, welded hard-surfaced overlays **and** the finest of metallized surfaces. Get maximum value through the dual usage of a Colmonoy Spraywelder.

HARD SURFACE cams, dies, rings, rolls, sleeves, and shafts with abrasion and corrosion resistant Colmonoy Sprayweld® Powders (5 grades), at 12 lbs. per hr., and with up to 95% efficiency.

METALLIZE with Colmonoy C-290 powder to rebuild crankshafts. Use other powdered metals to overlay worn journals, shafts, and bearings.

Learn more about the Spraywelder and Colmonoy hard-surfacing alloys. Write for the Sprayweld Catalog today.

HARD-SURFACING & BRAZING ALLOYS

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Cuts the FASTEST and FINEST NOTCHES *Ever Made!*

ARC-SNUG

ARC-SNUG gives you clean-edge, close-fitting, true contour notching by making both the first and second cuts of the notch in a single downstroke of the press. Notches ½" to 1¼" O.D. metal tubing (16 gauge and under) at angles ranging from 35 to 90 degrees. Special sizes and special dies to cut stainless steel, Monel metal, etc., made to order. Dies for various angles and sizes are interchangeable. Write for literature.

NOTCHED SAMPLES GLADLY FURNISHED

Combines 2 operations in one... **to give you the snuggest fitting, angular tubing joints for cheaper, quicker, easier welding.**

VOGEL TOOL & DIE CORPORATION
1819 NORTH 32ND AVENUE • STONE PARK, ILLINOIS

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NEW NEW NEW NEW NEW NEW NEW NEW NEW

WHEN IT

MELTS

you know the *temperature!*

NEW

Markal®

THERMOMELT

TEMPERATURE

INDICATORS

with handy adjustable holder

the easy modern way to determine exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

A STIK FOR EVERY TEMPERATURE from 113°F. to 2000°F.

ALSO AVAILABLE IN LIQUIDS AND PELLETS for inaccessible or hard-to-measure applications. Wide range of temperatures.

Send today for free THERMOMELT literature and pellet sample (indicate temperature desired).

MADE BY THE MANUFACTURERS OF MARKAL PAINTSTIK MARKERS AND PROTECTIVE COATINGS

MARKAL COMPANY 106° West Carroll Avenue, Chicago 12, Illinois

For More Information Circle No. 50 on Reader Service Card.

Self-Propelled Welder

Hobart Brothers Co. has completely redesigned its Weldmobile, a self-contained, self-propelled welding unit with engine directly coupled to the generator. In addition to welding power, the Weldmobile will supply up to one kilowatt of auxiliary power. It also can tow other equipment and material to the job.

Circle No. 215 on Reader Service Card.

Safety Hat Liners

The Fibre-Metal Products Company has announced a line of safety hat and helmet liners for winter comfort. The line includes: Neoprene-coated liners without metal parts, knitted liners, and disposable liners. One liner features a snap-on mouthpiece to give protection against wind.

Circle No. 216 on Reader Service Card.

Portable Sandblaster

The Handy-Blast portable sandblaster has been announced by Hamill Mfg. Co. Features of this 23-inch-high unit with a 7-inch diameter tank include: built-in sand funnel; automatic filler valve; Vari-Flow air operating valve; and adjustable sand flow valve. The unit is tested at 300 psi, and uses abrasive between 20 and 100 lb. mesh.

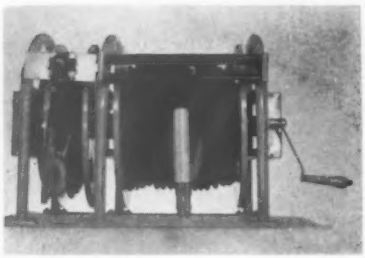
Circle No. 217 on Reader Service Card.

Insulated Chain Link

A low-voltage insulated link has been designed by E. D. Bullard Co. to prevent current flow from work to hoist. Current can burn out hoists and take temper out of chains.

Links come in ½- to 5-ton, 1 KV sizes, with a 4:1 safety and a 2:1 dielectric safety factor.

Circle No. 218 on Reader Service Card.



Cable Reel

United Specialties, Inc. has announced a double welding cable reel, Model EA-11, to handle two different cable lengths. The unit makes it possible to use and return the required amount of cable without delay or tangling. Current capacity is 300 amps, with 50 per cent temporary overload factor.

Circle No. 219 on Reader Service Card.

Wire Brazing Unit

An electric carbon-block brazing unit for joining both solid and stranded copper wire is offered by M. G. Steel Company. The floor mounted unit is foot operated. It uses 115 volt—60 cycle current and will braze from No. 30 to No. 16 AWG wire. Brazes are made with silver solder pellets, without flux.

Circle No. 220 on Reader Service Card.

Versatile Clamp System

Industrial Specialties, Inc. has developed a clamp system which uses 6 parts to make 32 different clamp styles. Parts are forged cold rolled steel. Bushings and spline-fit torque pins are hardened. Clamps assemble easily and rapidly with pins and snap rings.

Circle No. 221 on Reader Service Card.

A-C Welder

The Westinghouse Electric Corp. has developed a low-cost A-C welder known as West-Ing-Arc TC. Designed primarily for shipyard use, the TC is equally suitable for general heavy fabrication. The unit operates from 230/460 volts and is NEMA rated at 500 amps.

Circle No. 222 on Reader Service Card.

Hackney MILWAUKEE

high pressure cylinders are...

SMOOTH-SURFACED

- Cut maintenance costs—uniform surfaces clean easily, paint quickly.
- Have eye appeal—no crevices, cracks or ridges. Modern appearance for industrial and medical applications.

UNIFORM...DURABLE

- Every size has uniform capacity, controlled weight—filling, handling and record-keeping are simpler.
- Ruggedly constructed for long life. Hackney has spelled durability and quality workmanship since 1902. Every cylinder exceeds ICC specifications.

QUALITY-BUILT

- Hackney quality costs no more. And it gives you extra features such as accurate threading, neater appearance and legible stamping.
- Available in a complete range of sizes and shapes to meet any gas requirement—from small medicals to 220's, 250's and 300's (cu. ft.).

Economical, strong, safe Hackney cylinders meet your needs for every type of industrial gas. Central location means faster shipping with lower freight charges. Your nearest Hackney representative will be glad to give you complete specifications and quote prices.

Pressed Steel Tank Company

Manufacturer of Hackney Products Since 1902

1473 South 66th Street, Milwaukee 14, Wisconsin

Hackney MILWAUKEE

Branch Offices

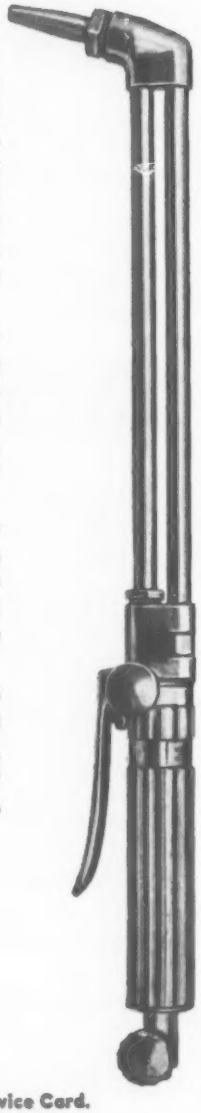
Clifton, N. J. · Atlanta, Ga. · Orlando, Fla. · Columbus, O. · Chicago, Ill. · St. Louis, Mo. · Marshfield, Mass. · Downingtown, Pa. · Detroit, Mich. · Los Angeles, Calif.

CONTAINERS AND PRESSURE VESSELS FOR GASES, LIQUIDS AND SOLIDS

For More Information Circle No. 56 on Reader Service Card.

VALUE VERSATILITY

···you get more of both in the PUROX TRADE MARK "E" Cutting Torch



When LINDE first offered the PUROX "E" Torch to industry, Ford's model T automobile sold for less than $500. Today's average car costs at least 350% more. *But the price of the "E" torch has gone up only 22%.* Since practically every part in it has been refined for improved performance and longer life, the PUROX "E"—granddaddy of cutting torches—is still one of the biggest oxy-acetylene apparatus values to be found anywhere.

Whatever your present requirements, there's a PUROX "E" Torch to take care of them. Choose a head angle of 75, 90, or 180 degrees in standard 20½-in. length, or a 36-in. model with 90-deg. head. Should new or special needs develop at any time, any model can be adapted to meet them by simply replacing the front-end assembly.

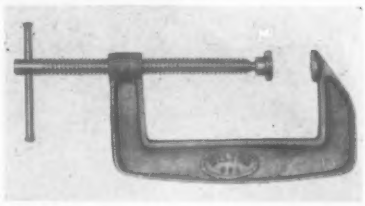
With four interchangeable front ends and 57 different nozzles, the PUROX "E" Torch easily handles any practical hand-cutting job. It cuts steel up to 12 in. thick, washes pads, cuts rivets, gouges, and pierces. *And it performs efficiently on acetylene or any other commercial fuel gas available.*

See the PUROX "E" Torch today at your LINDE Distributor's. Or write for free folder, F-1313. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde Trade Mark — UNION CARBIDE

The terms "Linde," "Purox," and "Union Carbide" are registered trade marks of Union Carbide Corporation.

For More Information Circle No. 45 on Reader Service Card.

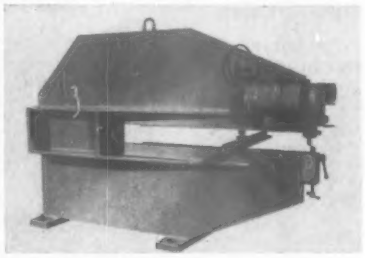


C-Clamps

A new "230" Series of C-clamps for light industrial applications has been introduced by Wilton Tool Mfg. Co., Inc. They are made of malleable iron and have screws with precision-cut modified Acme threads. They have a clamp swivel that is guaranteed never to come off.

Maximum capacities of the five different clamps range from 3 to 10 inches with standard depth range from 1⅞ to 3⅝ inches. Maximum proof test ranges from 2,000 to 4,000 pounds.

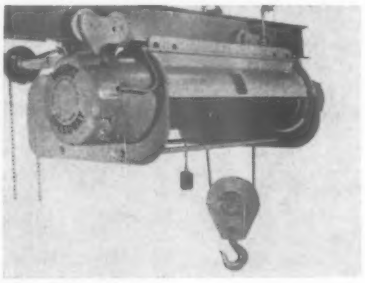
Circle No. 223 on Reader Service Card.



Shearing And Forming

A line of 5 universal shearing and forming machines has been introduced by American Pullmax Co. Designed to eliminate costly dies on small production runs, the new line will handle from 14 gage to 7/32" mild steel. The machines will do straight, irregular, and circular shearing, slotting, folding, beading, edge bending, joggling, and louver cutting.

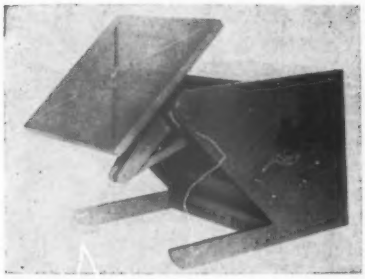
Circle No. 224 on Reader Service Card.



Electric Hoist

Write Hoist Div. of American Chain & Cable Co., Inc., has introduced an electric hoist called the Speedway Frame 3. It has a capacity of 12,000 pounds, a head room of 40 inches, a lift of 115 feet at 20 fpm, and can negotiate a 7-ft. radius curve. Its fully-enclosed 7.5 hp, ball bearing type motor can be of single, two or variable speeds.

Circle No. 225 on Reader Service Card.



Work Positioner

A new line of toggle-tilt work positioners has been added to the Welco line of mechanized welding equipment by the World Electric Company, Cleveland.

Adaptable to a variety of applications, the machine rotates and tilts the turn-table electrically to permit downhand welding. The turntable is T-slotted diagonally to allow the work to be clamped easily and securely in place.

Welco Toggle Tilt Positioners are available in capacities ranging from 2,500 to 25,000 pounds with table heights from 34½" to 95". The 30"-54" square turn-tables tilt through a 135 arc. The units may be ordered with non-electronic (20 to 1 ratio), electronic (100 to 1 ratio), or precision (full rpm with two cycles) variable speed controls.

Circle No. 226 on Reader Service Card.

QUIK®-HEAT

up to 2200° F.

CLEMENTS

Cadillac

MODELS K3 & M2

BLOWTORCHES

Here are rugged, high efficiency blowtorches that speed up all types of heat treating and production operations. These two Clements Cadillac Blowtorches provide heat up to 2200°F. in seconds and are fully portable.

With the Clements Cadillac model K3 or M2 you can bring the torch to the work instead of the work to the torch as in fixed installations. Furnished fully equipped with 20 ft. of Underwriters' Laboratories and Canadian Standards Association approved 3-wire cable with plug, 10 ft. of gas hose with fittings ready to attach to your gas line and with sturdy, high stability stand. Easily adjustable for height and direction of torch.

Operates on natural, manufactured, or LP-gas.

CLEMENTS MFG. CO.

6646 S. Narragansett Ave., Chicago 38, Ill.

SINCE 1910

INDUSTRIAL PRODUCTS DIVISION

Circle No. 20 on Reader Service Card.

Center Finder

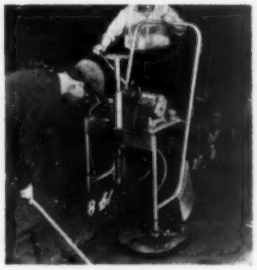
A center finder with an automatic spring-loaded punch has been developed by Manning Mfg. Co. The company explains that the tool can be used to make pipe layouts faster with greater accuracy. The tool locates any degree from 1° to 360° and establishes a true center line in less than one minute. It can be used for centering, quartering or eighthing any size pipe.

Circle No. 76 on Reader Service Card.

Power-Rotated Jib Crane

A power-rotated jib crane with a capacity of 20 tons has been introduced by R. G. Le Tourneau, Inc. The heavy-duty, all-weather crane permits one-man handling of all materials all year round. Jib span and ground clearance are available at up to 25 feet.

Circle No. 230 on Reader Service Card.



Hydraulic Clamps

Plate working can be speeded up by the new "Vic-Vac" Vacuum Clamps developed by R. Y. Pickering & Co., Ltd. A two-wheel unit and a portable model are available. Both are operated by one man. An electric vacuum pump provides the pads with the necessary "grip" while a hydraulic plunger applies pressure to the weldment.

The two-wheel model provides a clamping thrust of 7280 lbs. The hand unit provides 2,240 lbs thrust and up to 3,400 lbs thrust with bigger pads.

Circle No. 231 on Reader Service Card.

Your "LINDE" Distributor WANTS TO HELP YOU... TO DO A BETTER JOB!

Your success is his success. As your business improves, his business with you increases. As your confidence in him grows, it benefits you both.

Your local LINDE Distributor offers a complete line of industrial gases, equipment, and supplies. He can satisfy almost any welding or cutting need *from stock.*

Difficult welding or cutting problems? See your LINDE Distributor. His technical background and experience, backed by Linde Company resources, can help get you on the right track quickly.

Talk with your LINDE Distributor today. As an independent local businessman, he is vitally concerned with your success. If you can't find his name in your telephone directory, write for it. Dept. 310, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd St., New York 17, N. Y. *In Canada:* Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde

UNION CARBIDE

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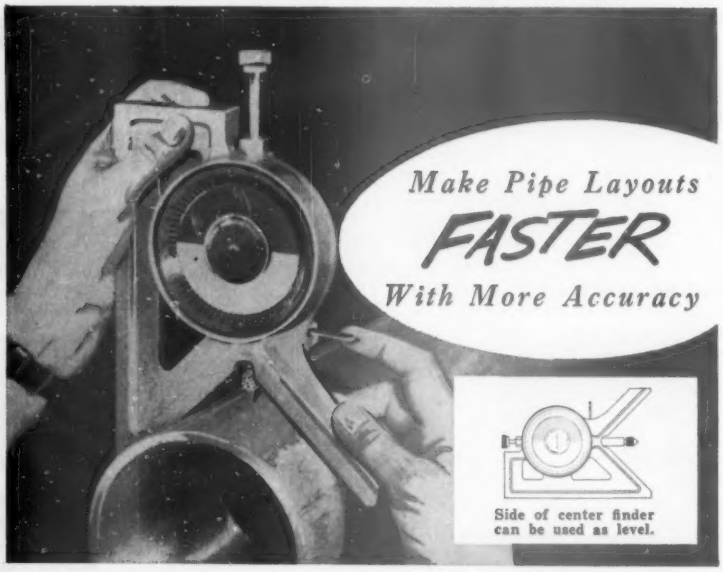
For more information Circle No. 76 on Reader Service Card.

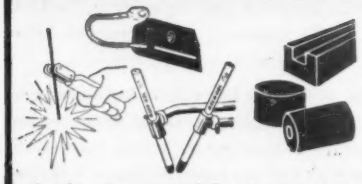


MANNING CENTER FINDER
With the Automatic Spring-loaded Punch!

For fast, precision pipe fabrication. Locate any degree from one degree to 360 degrees and establish a true center line in less than one minute. For centering, quartering or eighthing any size pipe. Automatic punch. Cuts back-charges and pipe salvaging to a minimum. Cuts labor time by as much as 90 per cent.

MANNING MFG. CO.
8202 CHANCELOR ROW • DALLAS, TEXAS
Distributor Inquiries Invited

BECKER
HAS IT...OR CAN MAKE IT—
if it's CARBON or GRAPHITE!



Graphite Cores and Chills—Graphite Powder and Particles of any mesh... complete Graphite Fabrication Facilities.

BRUSHES . . . for all motor and generator applications . . . carbon, graphite, copper leaf, gauze and metal-graphite.

WELDING ELECTRODES, WELDER BRUSHES . . . Keen-Cut Electrodes for carbon arc-air jet cutting . . . Keen-Arc Carbons, cored and heavily copper coated, for twin-arc torches . . . paste, rods and plates.

EXTRUSIONS, MOLDED SHAPES OR SPECIAL CARBONS designed and produced to your specifications.

COMPLETE BECKER ENGINEERING SERVICE is always available and entails no obligation whatever

Write for Catalog

BECKER BROTHERS CARBON CO.
3442 South Laramie Avenue • Cicero 50, Illinois
Telephone: BI 2-1260 • Chicago

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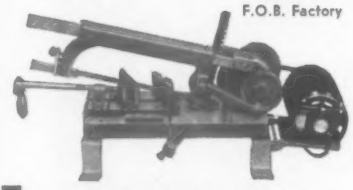
A Rugged . . . Versatile
POWER HACKSAW
COMPLETE ONLY $850.00
F.O.B. Factory



JEFFERSON "601"
Complete with motor and switch, wired, ready-to-go.

SAWS—bar, round, angle or pipe up to 5" x 4".

RUGGED—cast base, heavier guide bar support arms and guide bar with adjustable bronze wear plate and Oilite bearings throughout.

FEATURES—include fast acting 45° swivel vise, pressure relief on back stroke, length gauge bar, motor mount and ¼ h.p. motor. Built by builders of power hacksaws for industry since 1931.

Order from your Welding Equipment Dealer or write direct for details or prompt shipment.

KELLER DIV.
Sales Service Mfg. Co.
2365 University Ave., St. Paul 14N, Minn.

Circle No. 62 on Reader Service Card.

Lincoln Announces Design Award Program

CLEVELAND: A $25,000 Award Program for progress in arc welded design has been announced by The James F. Lincoln Arc Welding Foundation, Cleveland. The program offers cash awards for papers describing the welded steel design of either machines or structures.

Awards totalling $12,500 will be made to the best 38 papers in the mechanical division (a similar amount will be awarded to the same number of papers in the structural design group).

Complete rules may be obtained from the Foundation at Post Office Box 3035, Cleveland 17, Ohio. Competition closes July 17, 1961.

COMING EVENTS

November 28-29: Southeastern Zone Meeting, National Welding Supply Association, Hillsboro Hotel, Tampa, Florida.

December 1-2: Southwestern Zone Meeting, N.W.S.A., Hotel Roosevelt, New Orleans.

January 23-26, 1961: Plant Maintenance & Engineering Show, International Amphitheatre, Chicago.

March 24-25, 1961: Kansas Welding Show, Wichita Section, A.W.S. Wichita, Kansas.

Hawaiian Distributor Has 50th Anniversary

HONOLULU: GasprO, Ltd., a distributor of welding equipment and supplies and a manufacturer of welding and industrial gases in the 50th State, has celebrated its 50th anniversary by moving into a new main office and merchandise department.

The company distributes in Hawaii a wide variety of industrial products, equipment, supplies, and accessories. It also has several manufacturing plants for making clay and plastic products.

The firm was founded in 1909 by Allen Renton, now president and general manager. Allen H. Renton is executive vice president and sales manager.

New Distributors And Sales Representatives

Arcos Corporation, Philadelphia: Austin-Hastings Co., Cambridge, Mass.; Earlbeck Welding Supplies, Inc., Baltimore Md.; Monson Welding Sales, Inc., East Syracuse, N. Y.

Aro Spot Welder Div., Guthery Machine Tool Corp., Long Island City, New York: Nyberg Equipment Co., St. Louis.

Balteau Electric Corp., Stamford, Conn.; Electrotechnica Balteau, Mexico; Labquip, Inc., Chicago.

Carol Cable Co., Pawtucket, R. I.: Dupont-Bondurant, New Orleans.

Emerson Electric Mfg. Co., St. Louis: Andrus Equipment Corp. Huntington Park, California; Brient Yetter, Orinea, California.

Hobart Brothers Company, Troy, Ohio: Champion Industrial Sales Co., Houston; Earlbeck Welding Supplies, Baltimore; Holston Oxygen Co., Knoxville; K. C. Welding Supply, Bay City, Michigan; Techweld, Inc., Wilkes-Barre; Thompson Brothers Welding Supply, Coffeyville, Kansas.

Ransome Company, Scotch Plains, N. J.; Bakers Welding Supply Co., Bakersfield and Fresno, Calif.; Weld Tooling Corp., Pittsburgh; Charles S. Freeman Co., Buffalo.

A. O. Smith Corp., Milwaukee: Plains Welding Supply, Plainview, Texas; Western Air Products Co., Lubbock, Texas; West Texas Welders Co., Midland, Texas; Western Oxygen Co., Odessa, Texas; Pecos Welding Supply, Pecos, Texas; Western Oxygen of New Mexico, Hobbs and Roswell.

United Specialties, Inc., El Dorado, Arkansas: W. J. Bernhart, Inc., Buffalo; Craig Industrial Equipment Co., Memphis; Industrial Engineering Sales Co., Chicago; and Nicholson Products Co., Clifton, N. J.

Unitek Corporation, Weldmatic Division, Monrovia, Calif.: Tech-Ser, Inc., Los Angeles.

Welsh Mfg. Co., Providence: Midwestern Warehouse, 1736 South Michigan Ave., Chicago.

FACTS AT YOUR FINGERTIPS: *If you want information on products featured in this issue, just circle the appropriate numbers on the bound-in Reader Service Card.*

Miss Liberty says:
"CONFIDENTIALLY I PREFER A Dockson TORCH"

Dockson Welding and cutting torches are lighter, better balanced, built to last with rigid, silver soldered one piece construction. Designed to do the job better, faster.

Service parts available from stock.

Check the complete Dockson line of Better Built Welding Equipment. Write for catalog 56-05.

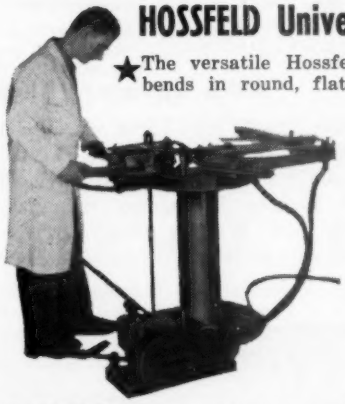
Dockson CORPORATION

3839 Wabash Ave., Detroit 8, Mich.

make hundreds of bends

(simple–tough–complex ★) with a

HOSSFELD Universal® Iron Bender



★The versatile Hossfeld Universal Bender makes hudreds of bends in round, flat or square bar stock, angle iron, pipe, tubing, and conduit. It's invaluable for maintenance, limited production work.

OVER 150 STANDARD DIES

Practically any everyday bend can be reproduced by the Hossfeld with one of the more than 150 standard dies available. This versatile Hossfeld bender sets up quickly, and is wrenchless for ready use. It's as indispensable as bench vise.

This difficult bend in 4" flat stock was made easily, accurately.

3 MODELS Available in a model to fit your particular needs: Hossfeld No. 1 for light shop work, Hossfeld No. 2 for heavier work, Hossfeld No. 2 with hydraulic attachment for tough hard-to-pull bends on heavy material.

FREE Illustrated Bender Bulletin. Write for yours today.

HOSSFELD MFG. CO.

436 WEST 3rd STREET • WINONA, MINNESOTA

For More Information Circle No. 40 on Reader Service Card.

Circle No. 18 on Reader Service Card.

BATEMAN
BANTAM
IRON WORKER

THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

IN 1936, MORT CLARK, then Vice-President of the world's largest sign manufacturer, wanted a welded galvanized sign frame. Every welder manufacturer said it couldn't be done . . . Mort Clark did it, received a check and certificate of achievement from the Lincoln Welding Foundation—and

MORT CLARK'S GALV-WELD ALLOY ORIGINAL & GENUINE

WAS BORN

The Navy didn't believe, tested it 3384 hours in salt spray (100 hours is normal), then approved it. Westinghouse reports Galv-Weld roof sign, installed 1936—still perfect in 1959—23 YEARS LATER!

TIME PROVEN — MODESTLY PRICED
WHY EXPERIMENT?

Regalvanizes corrosive seams and areas where galvanizing is burned away by welding, skipped in hot dip galvanizing, or abraded in fabrication.

Eliminates corrosion areas produced by welding, so that weld will stand up under paint, WITHOUT rust, as on ornamental iron. Simply use residual heat from welding, or reheat, wire brush, and apply. No fluxing—No fumes.

Makes every welder a galvanizer of small weldments or parts. Repairs chipped porcelain, rusted appliances, rusted auto, truck or trailer bodies, frames, fenders, or other steel products. Can be readily refinished to match surrounding surface.

Ideal for pipe joints, galvanized structures, water and fuel tanks, duct systems, cold storage lockers, sinks, drains, washers, towers, steel buildings, railings, etc.

Some distributor franchises still available. Cash in on consistent campaign now running in 7 national magazines.

Mail Coupon Today

GALV-WELD PRODUCTS
Dept. WDF — Box 1303 — Bradenton, Fla.
Send Information User ☐ Distributor ☐
Dealer ☐ Free Sample ☐
Name .....
Address .....
City ..... State.....

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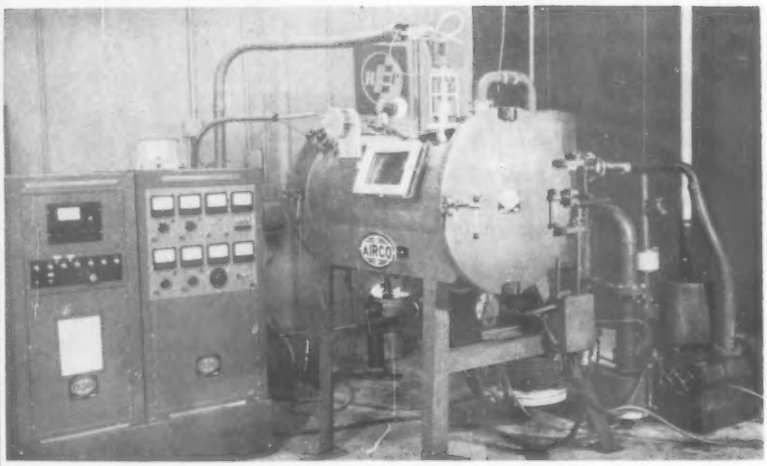

ELECTRON BEAM WELDER has a 36-inch chamber and can weld exotic metals from 0.003 inch foil sheet to 0.500 inch plate.

Minneapolis engineering company installs new electron beam welder

MINNEAPOLIS: Rosemount Engineering Company's new Welding Division has a $35,000 electron beam welder. Leonard F. Akers, head of the new division, reports the machine is the first of its kind to be installed in a welding and fabricating shop. He says the machine now gives Rosemount one of the best equipped welding facilities in the country.

Dr. Frank Werner, president, says these modern welding facilities will serve a dual purpose. They'll help the company improve its own line of temperature and pressure transducers. They'll also help the company expand through diversification. It is expected that 50 percent of the Welding Division's work load will be outside work, including research and development jobs and special or unusual production runs.

AWS Sponsors Three Educational Courses

NEW YORK CITY: Three educational courses are being sponsored by the American Welding Society's School of Welding Technology this Fall. They are: Welding Metallurgy, October 31 to November 4; Weld Testing and Inspection, November 14 to 18; and Piping, February 6 to 10 (tentative).

Full details are available from the AWS at 33 West 39th Street, New York 18, New York.

THIS ADVANCED RESEARCH CENTER is being built at Middleton, Wis., by the A. O. Smith Corp., Milwaukee. Preliminary plans call for the construction of a 50,000 square foot building costing approximately $2 million.

Data Offered In This Month's Ads

Readers may obtain any of these free reference materials by circling the corresponding numbers on the Reader Service Cards

7: Welding machinery for special or general purpose welding is featured. **Acro Welder Mfg. Co.**

8. Cutting and welding equipment are featured. **Air Reduction Sales Co.**

9: Pocket guides are available. **Air Reduction Sales Co.**

10: Ejector holders that end leakage during spot welding are explained. **Air Reduction Sales Co., Tuffaloy Dept.**

11: Alloys and fluxes are subject of two manuals. **All-State Welding Alloys Co., Inc.**

12: Stainless steel welding explained in literature. **Alloy Rods Company.**

13: Welding rod information is contained in Publication 13. **Anaconda American Brass Company.**

14: Silver brazing is the subject of booklet. **American Platinum & Silver Div., Engelhard Industries.**

15: Resistance-welding electrode for high-temperature use is subject of catalog. **Ampco Metal, Inc.**

16: Belt grinder that is air powered is featured. **Aro Equipment Corp.**

17: Positioners from over 400 stock models are featured. **Aronson Machine Co., Inc.**

18: A punch and sheer for metal under 1/4-inch thick is featured in literature. **Bateman Foundry & Mach. Co.**

19: Carbon arc gouging using Keen-Cut electrodes is featured in material. **Becker Brothers Carbon Co.**

20: Blowtorches which operate on natural, manufactured, or LP-gas are described. **Clements Mfg. Co.**

21: Hydraulic tools for welding and fabricating are featured in how-to-do-it booklet. **Blackhawk Mfg. Co.**

23: Receptacles and plugs in many sizes and designs are described in a bulletin. **Cam-Lok Div., Empire Products, Inc.**

24: A Tong-type ac/dc ammeter is featured in material. **Columbia Electric Mfg.**

25: Welding and cutting torches are described in catalog. **Dockson Corp.**

26: Electrode holders with adjustable spring tension are described. **Duro Engineering Co.**

27: X-ray film for non-destructive testing is featured in literature. **Eastman Kodak.**

28: Low-frequency induction heating is the subject of a brochure. **Electric Arc., Inc.**

29: Arc-welding accessories are featured. **Erico Products, Inc.**

30: Ultrasonic weld inspection equipment is discussed. **Bronson Industries Inc.**

31: Welding helmets are described in Catalog No. 26. **Fibre-Metal Products Co.**

32: Galvanizing of small parts and weldments is described in literature. **Galv-Weld Products.**

34: Pipe Cutting and beveling machines are listed in catalog. **H & M Pipe Beveling Machine Co.**

35: Caster and wheels for industrial use are featured in a catalog. **Hamilton Caster & Mfg. Co.**

36: Axle assemblies, jacks, couplers, and spindle assemblies are featured in Catalog 18M. **Hammer Blow Tool Co.**

37: Metering regulators are featured. **Harris Calorific Co.**

38: Gas cylinders are described. **Harrisburg Steel Co.**

39: Faster welding gun is described in literature. **Hobart Brothers Co.**

40: Iron Benders available with 147 dies are featured in a bulletin. **Hossfeld.**

41: "Repair Cast Iron Parts Quickly and Easily" is the title of literature. **International Nickel Co.**

42: Ground clamps, cable connectors and cable lugs are featured. **Jackson Products.**

43: Consult your welding supply distributor about your welding problems. **Lenco, Inc.**

44: Consulting for welding and designing are explained. **Lincoln Electric Co.**

45: Oxy-acetylene torch with 57 different nozzles is featured. **Linde Co.**

46: Welding and cutting needs are discussed. **Linde Co.**

47: One welder for spray arc, short arc, and spot welding is featured. **Linde Co.**

49: Magnetic particle inspection is featured. **Magnaflux Corp.**

50: Temperature indicators that melt at desired temperature are described in literature. **Markal Co.**

51: Wire gun and powder gun hard facing is described. **Metco, Inc.**

52: Galvanizing welds is the subject of information which includes a sample. **Metalloy Products Co.**

53: Combination welder/power plant specifications featured. **Miller Electric Mfg. Co., Inc.**

54: Welding wire is described and illustrated in literature. **Page Steel & Wire Div., American Chain & Cable Co.**

55: Training course on basics of radiography is offered. **Picker X-Ray Corporation.**

56: High pressure cylinders are featured in a catalog giving prices and specifications. **Pressed Steel Tank Company.**

57: Welder rectifiers are discussed in literature. **Radio Receptor Co., Inc.**

59: Consultation and welding service is featured. **Rosemount Engineering Co.**

60: Welding fume details described in literature. **Rumelin Mfg. Co.**

61: Resistance welding supplies are featured in a catalog. **S-M-S Corp.**

62: Power hacksaw is described in literature. **Sales Service Mfg. Co.**

63: Carbide is featured in literature. **Shawinigan Products Corp.**

64: Button welding is described in Bulletin MW-253. **A. O. Smith Corp.**

66: Hot rolled plate steel is featured in literature. **Stulz-Sickles Co.**

67: Tungsten electrodes are discussed. **Sylvania Electric Products Inc.**

68: Electrodes for resistance welding are featured in a catalog. **Tipaloy, Inc.**

69: Automatic welding manipulator is described in literature. **Tri-City Tool And Machinery Co.**

70: AC-DC 3-phase input arc welder is described in Bulletin 7206-3. **Vickers Inc.**

71: Gaugeless regulators, single-stage or two-stage, are featured. **Victor Equipment Co.**

72: Metal tubing notcher for angular joints featured in literature. **Vogel Tool & Die Corp.**

73: Hard-surfacing alloys are discussed in a catalog. **Wall Colmonoy Corp.**

74: Argon fittings are subject of catalog. **Western Enterprises Inc.**

76: Pipe center finder with automatic punch is featured. **Manning Mfg. Co.**

77: Hardening of wearing parts is featured. **Hard-N-Tuff Corp.**

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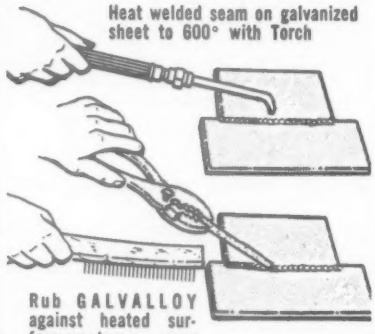
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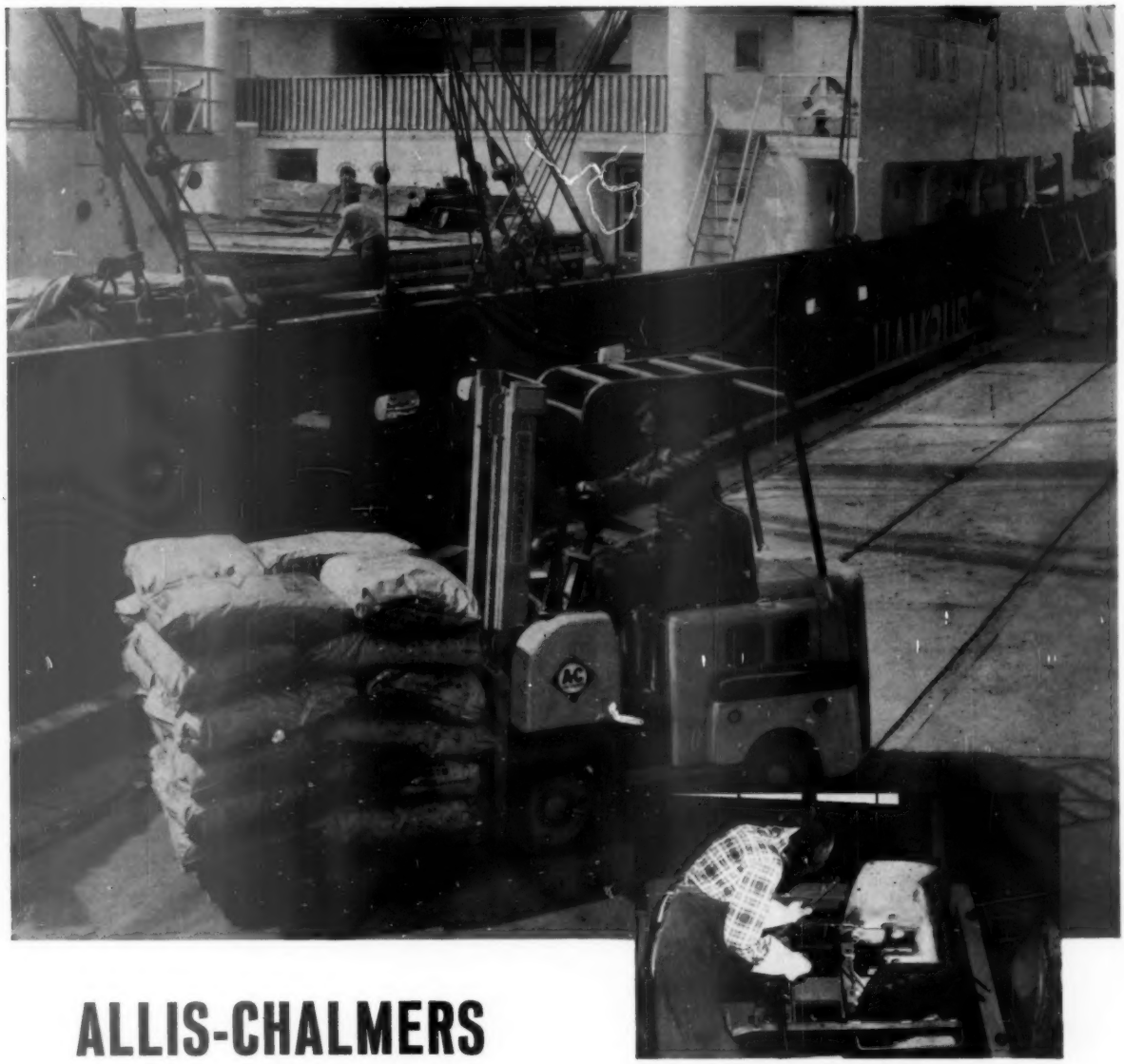
ADVERTISERS' INDEX

for November, 1960

Acro Welding Mfg. Co. 62
Air Reduction Sales Co. 11, 63
Air Reduction Sales Co.
Tuffaloy Department 12
All-State Welding Alloys Co., Inc. 58
Alloy Rods Co. 15
American Chain & Cable Co.
Page Steel & Wire Division 28
American Platinum & Silver Division,
Engelhard Industries 55
Ampco Metal, Inc. 24
Anaconda American Brass Co. 53
ARO Equipment Corporation 27
Aronson Machine Co. 2
Bateman Foundry & Machine Co. 72
Becker Brothers Carbon Co. 70
Blackhawk Mfg. Co. 50
Branson Instruments Co. 40
Cam-Lok Division,
Empire Products, Inc. 4
Clements Mfg. Co. 69
Columbia Electric Mfg. Co. 74
Curtiss-Wright Corp.
Princeton Division 7
Dockson Corp. 71
Duro Engineering Co. 60
Eastman Kodak Co. 37
Electric Arc Inc. 18
Engelhard Industries, Inc.
American Platinum & Silver Div. 55
Erico Products, Inc. ....Inside Back Cover
Fibre Metal Products Co. 10
Galv-Weld Products 72
H & M Pipe Beveling Mach. Co. 62
Hamilton Caster & Mfg. Co. 54
Hammer Blow Tool Co. 64
Harris Calorific Co. 5
Harrisburg Steel Co.
Div. of Harsco Corp. 17
Hobart Bros. Co. 1
Hossfeld Mfg. Co. 71
Hard-N-Tuff Corp. 74
International Nickel Co., Inc. 19
Jackson Products ....Inside Front Cover
Lenco, Inc. 30
Lincoln Electric Co. 56-57
Linde Company, Division of
Union Carbide Corp. 21-22, 68, 69
Magnaflux Corp. 14
Manning Mfg. Co. 70
Markal Co. 66
Metco Inc. 61
Metalloy Products 74
Miller Electric Mfg. Co. 42
Page Steel & Wire Division
American Chain & Cable Co. 28
Picker X-Ray Corp 16
Pressed Steel Tank Co. 67
Radio Receptor Co., Inc. 13
Rosemount Engineering Co. 47
Rumelin Mfg. Co. 60
S-M-S Corporation 59
Sales Service Mfg. Co. 70
Shawinigan Products Corp. 12
A. O. Smith Corporation 8, 9
Stulz-Sickles Company 49
Sylvania Electric Products Inc. 41
Tec Torch Co. 51
Tipaloy, Inc. 64
Tri-City Tool & Machinery Corp. 54
Vickers, Inc.
Electric Products Division 29
Victor Equipment Co. 25
Vogel Tool & Die Corp. 65
Wall Colmonoy Corp. 65
Western Enterprises 59



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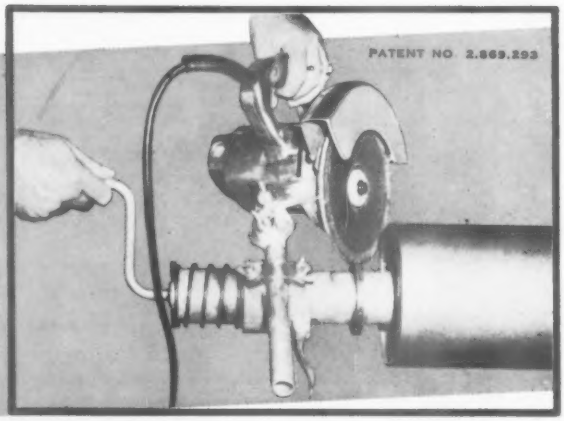

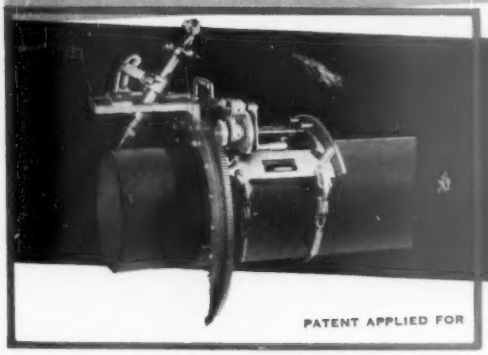

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